

ADDITIONAL NOTES ON THE GENUS AVICENNIA. VII

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AVICENNIA L.

Additional & emended bibliography: G. Don in Loud., Hort. Brit., ed. 1, 247. 1830; Hubert, Trav. Lab. Mat. Méd. Fac. Pharm. Paris 13: 114—121. 1921; Fedde in Just, Bot. Jahresber. 46 (2): 554. 1929; G. T. Hastings, *Torreya* 34: 157. 1935; J. M. Johnson, *Torreya* 34: 138. 1935; P. H. Fisher, Mém. Soc. Biogeogr. 8: 315—329. 1940; Scholander, Hammel, Hemmingsen, & Garey, Am. Journ. Bot. 42: 92—98. 1962; Arulchelvam, Ceylon Forest., ser. 2, 8: 60, 62, 73—75, 81, & 91. 1968; Cochrane, Fuhrer, Rotherham, & Willis, Austral. Fls. in Col. Vict. 72, 183, & 207, pl. 190 & 191. 1968; Coomans, Malacologia 9: 79—84. 1969; Anon., Biores. Index 6: 4689. 1970; Hartwell, *Lloydia* 34: 386 & 428. 1971; McCusker, Ann. Bot. Lond. 35: [707]—712, fig. 1 & 2, pl. 1. 1971; Erickson, George, Marchant, & Morcombe, Austral. Fls. in Col. West. Austr. 13, 205, & 209. 1973; Howard, Journ. Arnold Arb. 54: 443. 1973; F. R. Fosberg in Multer & Gerhard, Guideb. Geol. Ecol. St. Croix [W. Ind. Lab. Fairl. Dick. Univ. Spec. Publ. 5:] 240. 1974; Napp-Zinn, Anat. Blat. 153, 160, 244, 283, 394, 434, 632, 658, 1079, & 1326. 1974; Salmon, N. Zeal. Fls. & Pl., ed. 2, imp. 3, 23 & 227. 1974; Täckholm & Boulos, Suppl. Stud. Fl. Egypt 95. 1974; Balgooy, Pacif. Pl. Areas 3: 14 & 243—244. 1975; Golley & Medina, Trop. Ecol. Stud. [Jacobs, Lange, Olson, & Wieser, Ecol. Stud. 11:] 391. 1975; Lugo, Evink, Brinson, Broce, & Snedakar in Golley & Medina, Trop. Ecol. Stud. [Jacobs, Lange, Olson, & Wieser, Ecol. Stud. 11:] 335, 337—339, & 344. 1975; Moldenke, Phytologia 32: 437—457, fig. 1—5. 1975; Pannier in Golley & Medina, Trop. Ecol. Stud. [Jacobs, Lange, Olson, & Wieser, Ecol. Stud. 11:] 344 & 349. 1975; J. C. & N. C. Roberts, Field Guide Baja Calif., ed. 1, 12, 17, 18, 29, 35, 154, & [155]. 1975; G. Rodríguez in Golley & Medina, Trop. Ecol. Stud. [Jacobs, Lange, Olson, & Wieser, Ecol. Stud. 11:] 330. 1975; Walter, Harnickell, & Mueller-Dombois, Climate-diagr. Maps 32. 1975; Weberling & Schwan-tes, Pflanzensyst., ed. 2 [Ulmer, Uni-Taschenb. 62:] 144. 1975; Moldenke, Phytologia 32: 507—509 & 511. 1976.

The Täckholm & Boulos (1974) publication, cited above, is dated "1972" on its title-page, but was not actually published until November 20, 1974,

Chapman (1944) describes five kinds of roots produced by A. germinans: primary adventitious, horizontal, anchoring, absorbing, and pneumatophores. McCusker (1971) found all five in A. marina, plus knee roots; Chai has found stilt-roots in A. alba.

It is of passing interest to note the occurrence of a "mangrove-leaved akeake" (Olearia avicenniaefolia) in New Zealand.

Golley, Odum, & Wilson (1962) inform us that mangroves "of one sort or another" cover about 1/3 of the coastlines of tropical America.

Napp-Zinn (1974), the plant anatomist, should be added to the list of botanists who accept the Avicenniaceae as a distinct botanical family. Ah See Tan & Keng (1969) have conducted detailed comparative morphological studies on four different species of Avicennia in the Singapore area.

AVICENNIA AFRICANA P. Beauv.

Additional & emended bibliography: V. J. Chapman, Trop. Ecol. 11: 4, 5, 8, & 16, fig. 3. 1970; Janík, Preslia 42: 105, 106, 111, & 112. 1970; Moldenke, Phytologia 32L 436--440. 1975.

Additional citations: NIGERIA: Southern: Elliott, Choloner, & Molshi s.n. [28/5/1966] (Ln--245562).

AVICENNIA ALBA Blume

Additional & emended synonymy: Avicennia tomentosa Griff. apud H. Hallier, Meded. Rijks Herb. Leid. 37: 87, in syn. 1918 [not A. tomentosa Blanco, 1845, nor R. Br., 1851, nor Jacq., 1760, nor L., 1826, nor L. & Jacq., 1783, nor G. F. W. Mey., 1818, nor Nutt., 1947, nor Nutt. & Br., 1832, nor Roxb., 1835, nor Schau., 1940, nor Sieber, 1944, nor Sw., 1864, nor Vahl, 1921, nor Weigelt, 1851, nor Willd., 1822]. Avicennia tomentosa Blume ex H. Hallier, Meded. Rijks Herb. Leid. 37: 88. 1918.

Additional bibliography: Burm. f., Fl. Ind. 138. 1768; Bascope, Bernardi, Jorgensen, Hueck, Lamprecht, & Martinez E., Mangl. Am. [Inst. Forest. Latinoam. Invest. Capac. Descrip. Arb. Forest. 5:], imp. 1, 13 (1959) and imp. 2, 13. 1970; Balgooy, Pacif. Fl. Areas 3: 243. 1975; Moldenke, Phytologia 32: 440--453 & 456, fig. 1--5. 1975.

Additional illustrations: Moldenke, Phytologia 32: 444--448, fig. 1--5. 1975.

Van der Kieve describes this tree as being a "shrub-like tree, 2--5 m. tall", having black trunk and branches, with many pneumatophores, and with flowers "yellow to orange" or "orange-yellow", and being "very common on moderate firm soils or soft mud on seashores and on mud-flats" in mixed mangrove forests.

It is of interest to note that Hallier (1918) includes in the synonymy of this species "A. officinalis (haud L.) Schauer l.c. (1851) p. 306 quoad syn. Bl.! secundum". I regard A. officinalis Schau. nomenclaturally as synonymous with A. marina var. rumphiana (H. Hallier) Bakh. regardless of the synonymys which he included. Hallier cites Falconer 241 from Tenasserim, Pierre 1863 from Cochinchina, Beccari 1770 from Borneo, Blume 1700 and Raap 429 from Java, and Teijsmann 7459 from New Guinea. Under what he calls "Avicennia tomentosa (haud Jacq. nec Willd. nec R. Br. nec Roxb. etc.) Bl.!" he cites A. officinalis Schau. and A. intermedia Griff. as synonyms, listing as illustrative collections: Hallier 3520 from Luzon, Blume 1152, Boerlage s.n., Hasskarl s.n., Kuhl & Hasselt s.n., Raap 402, and Waitz s.n. from Java, deVriese s.n. from Bali, Hallier B.281 from Borneo, and Forsten s.n. from Celebes. He records the vernacular name, "kajuh tando". On Hal-

lier B.281 the corollas are described as having been "grünlich-gelb". I regard A. intermedia Griff. as a synonym of A. marina (Forsk.) Bakh., possibly deserving varietal recognition, but certainly having nothing to do with A. alba Blume.

Additional citations: THAILAND: Van der Kevie 1 (N), 7 (N).

AVICENNIA BALANOPHORA Stapf & Moldenke

Additional bibliography: Bascope, Bernardi, Jorgensen, Hueck, Lamprecht, & Martinez E., Mangl. Am. [Inst. Forest. Latinoam. Invest. Capac. Descrop. Arb. Forest. 5:], imp. 1, 13 (1959) and imp. 2, 13. 1970; Moldenke, Phytologia 32: 453. 1975.

AVICENNIA BICOLOR Standl.

Additional & emended bibliography: Bascope, Bernardi, Jorgensen, Hueck, Lamprecht, & Martinez E., Mangl. Am. [Inst. Forest. Latinoam. Invest. Capac. Descrop. Arb. Forest. 5:], imp. 1, 13 & 16 (1959) and imp. 2, 13 & 16. 1970; Moldenke, Phytologia 32: 453--454. 1975.

AVICENNIA EUCALYPTIFOLIA Zipp.

Additional synonymy: Avicennia officinalis Miq. apud H. Hallier, Meded. Rijks Herb. Leid. 37: 87, in syn. 1918 [not A. officinalis L., 1753, nor H. J. Lam, 1940, nor Maxim., 1932, nor Millsp., 1930, nor Schau., 1856].

Additional bibliography: Balgooy, Pacif. Pl. Areas 3: 243. 1975; Moldenke, Phytologia 32: 455--457. 1975.

Stoddart, in his splendid exploration of the Great Barrier Reef islands, describes this species as a shrubby tree, 2--10 m. tall, or a low shrub, 1--4 m. tall, with light bark and vertical pneumatophores. He found it common on the seaward side of shingle ridges on shingle islands, in moats and on seaward shingle ramparts of sand-shingle islands, in mangrove swamps generally, on beachrock on the windward side of sand cays, common on sheltered peripheral reef flats, and common on mangrove-shingle islands where it is in the shoreline mangrove on shingle and rock flats or common at mangrove-rock margins, at altitudes of 1--2 meters, flowering in October and November. He has identified it as what he refers to as A. marina var. australasica (Walp.) Moldenke, but it seems more likely to me that the latter name will prove synonymous with A. marina var. resinifera (Forst.) Bakh., a taxon which is quite distinct from A. eucalyptifolia.

Hallier (1918) cites Spanoghe and Zippelius collections from Timor and Branderhorst 227, Koch E.36, Versteeg 1893, and Zippelius 87d from New Guinea, all deposited in the Leiden herbarium, and records the vernacular name, "daon kaju buluh ajam". In addition to the months previously reported by me, it has been collected in fruit in October. Hallier comments that "Diese und die folgende Art [A. tomentosa Blume" = A. alba] sind vielleicht nur Varietäten einer spitzblättrigen Art, die im Reichsherbar von Neuseeland und Timor als A. resinifera Forst. und des weiteren

von Neukaledonien, Ost-australien, Ternate (Forsten), Mindanao (Elmer no. 11990 = A. mindanaënsis Elm.! Piper no. 174), Pan-ay (Curran no. 17337) und Luzon (Vidal no. 496) vorliegt. Die A. tomentosa Bl. scheint mit letzterer durch Exemplare von Ostjava (Junghuhn) und Madurah (de Vriese) verbunden zu sein. Auch die vorderindische A. alba (haud Bl.!) Wight und die ostafrikanisch-arabische A. marina Vierh. scheinen ihr nahe zu stehen." I regard A. alba Wight and A. mindanaënsis Elm. as synonyms of A. marina (Forsk.) Vierh., A. resinifera Forst. as the name-bringing synonym of A. marina var. resinifera (Forst.) Bakh., and A. tomentosa Blume as a synonym of A. alba Blume.

Additional citations: GREAT BARRIER REEF: East Petheridge: Stoddart 4762 (W--2744343). Fisher: Stoddart 5102 (W--2744258). Pipon: Stoddart 4869 (W--2744342). Turtle I: Stoddart 4697 (W--2744260). Turtle III: Stoddart 4745 (W--2744272). Two Isles: Stoddart 4636 (W--2744250). West Petheridge: Stoddart 4774 (W--2744330).

AVICENNIA GERMINANS (L.) L.

Additional & emended synonymy: Bontia? Foliis integris oblongis oppositis, petiolis crassis brevissimis sub amplexantibus, floribus racemosis P. Br. in Sloane, Civil & Nat. Hist. Jamaic., ed. 1, 263. 1755. Mangle lauro-cerasi foliis, flore albo tetrapetalo "Sloane Cat. 156 & H. 2: 66--67" apud P. Br., Civil & Nat. Hist. Jamaic., ed. 1, 263, in syn. 1755. Bontia nitida Loebl. ex Scop., Introd. Hist. Nat. 169. 1777. Conocarpus procumbens Warden, Statist. Polit. Hist. Acct. U. S. 2: 523, in textu. 1819 [not C. procumbens L., 1753]. Avicennia officinalis $\propto$ nitida (Jacq.) Kuntze, Rev. Gen. Pl. 2: 502. 1891. Averrhoa nitida Wilder, Frag. Path 326, sphalm. 1932. Avicennia nitida (alter) Sessé & Moc. ex Navalkar, Journ. Bombay Nat. Hist. Soc. 53: 342. 1956. Avicinnia nitida Ambasht, Text-book Pl. Ecol. 169 & 191, sphalm. 1969. Avicenna tomentosa Jacq. ex Farnsworth, Blomster, Quimby, & Schermerh., Lynn Index 6: 263, sphalm. 1969. Avicennia germinans Stearn ex J. F. Morton, 500 Pl. S. Fla. 29. 1974. Avicenna germinans Cloudsley-Thomp., Terrestr. Environ. 36, sphalm. 1975. Avicennia germinans (L.) P. Br., in herb. Avicennia germinans Gaertn. f., in herb. Avicennia germinans (L.) L., in herb. Avicennia nitida L., in herb.

Additional & emended bibliography: P. Br. in Sloane, Civil & Nat. Hist. Jamaic., ed. 1, imp. 1, 263 (1755) and ed. 1, imp. 2, 263. 1756; Burm. f., Fl. Ind. 138. 1768; [Retz.], Nom. Bot. 156. 1772; Romans, Concise Nat. Hist., ed. 1, 6. 1775; Scop., Introd. Hist. Nat. 169. 1777; J. F. Gmel. in L., Syst. Nat., ed. 13, imp. 1, 2: 963 (1789) and ed. 13, imp. 2, 2: 963. 1796; Raeusch., Nom. Bot., ed. 3, 182. 1797; H.B.K., Nov. Gen. & Sp. Pl., ed. folio, 2: 228--231 (1817) and ed. quart., 2: 283--285. 1818; Pers., Sp.

Fl. 3: 359. 1819; Warden, *Statist. Polit. Hist. Acct. U. S.* 2: 523. 1819; Harv., *Gen. S. Afr. Pl.*, ed. 1, 271. 1838; Hook., *Trans. Linn. Soc. Lond. Bot.* 20: 195. 1847; Hook. f. & Benth. in Hook., *Niger Fl.* 487. 1849; Twining, *Ill. Nat. Ord. Pl.* 2: 104. 1855; A. Wood, *Am. Bot. & Flor.*, ed. 1, imp. 1, 235 (1870), ed. 1, imp. 2, 235 (1871), ed. 1, imp. 3, 235 (1872), ed. 1, imp. 4, 235 (1873), ed. 1, imp. 5, 235 (1874), and ed. 1, imp. 6, 235. 1875; J. Sm., *Dict. Pop. Names Pl.* 264. 1882; Warming in *Engl., Bot. Jahrb.* 4: 319. 1883; Watt, *Econ. Prod. India* 5: 49. 1883; C. B. Clarke in Hook. f., *Fl. Brit. India* 4: 606. 1885; Schenck, *Flora* 72 [ser. 2, 44]: [83]—[89], pl. 3, fig. 1—6. 1889; O. R. Willis in A. Wood, *Am. Bot. & Flor.*, ed. 2, 235. 1889; T. S. Brandeg., *Proc. Calif. Acad. Sci.*, ser. 2, 3: 164. 1893; Jacks. in Hook. f. & Jacks., *Ind. Kew.*, imp. 1, 1: 254, 322, & 788. 1893; Solered., *Syst. Anat. Dicot.* 713—717, fig. 151 G. 1899; Huber, *Arboret. Amaz.* 15 & 17, pl. 17. 1900; T. Peckolt, *Bericht. Deutsch. Pharm. Gesell.* 14: 482. 1904; C. S. Sarg., *Man. Trees N. Am.*, ed. 1, 790 & [819]. 1905; D. H. Scott in Solered., *Syst. Anat. Dicot.* [transl. Boodle & Fritsch] 1: 631—633 & 635, fig. 151 G. 1908; Solered., *Syst. Anat. Dicot. Ergänzt.* 254 & 255. 1908; Groom & Balf. in Warming & Vahl, *Oecol. Pl.*, imp. 1, 235—236. 1909; A. R. Northrop in J. I. Northrop, *Naturalist in Bahamas* 180, 204, & 218. 1910; Goyena, *Fl. Nicarag.* 1: 570. 1911; Bournot, *Arch. Pharm.* 251: 351—354. 1913; Bournot, *Chem. Abstr.* 8: 677. 1914; Stevens, *Ill. Biol. Monog.* 2: 14. 1916; L. R. Wheeler, *Journ. Bot.* 54: 48. 1916; Bowman, *Ecol. & Physiol. Red Mangr.* [*Proc. Am. Philosoph. Soc.* 56 (7):] 597, 621, 653, & 659. 1917; Chardon, *Mycologia* 12: 318. 1920; Bakh., *Bull. Jard. Bot. Buitenz.*, ser. 3, 3: 218, pl. 22. 1921; Ernould, *Mém. Acad. Roy. Belg. Cl. Scienc.*, ser. 2, 6: 7. 1921; Lowe, *Miss. State Geol. Surv. Bull.* 17: 238. 1921; C. S. Sarg., *Man. Trees N. Am.*, ed. 2, imp. 1, 2: 866—867, fig. 765. 1922; Wangerin in *Just, Bot. Jahresber.* 51 (1): 553 [519]. 1923; Groom & Balf. in Warming & Vahl, *Oecol. Pl.*, imp. 2, 235. 1925; Record, *Trop. Woods* 1: 7—9. 1925; Toro, *Mycologia* 17: 139. 1925; Janssonius, *Mikrogr. Holz.* 754, 830, & 831. 1926; Record, *Chem. Abstr.* 20: 3309—3310. 1926; C. S. Sarg., *Man. Trees N. Am.*, ed. 2, imp. 2, 2: 866—867 & [899]. 1926; Stevens, *Ann. Mycol.* 25: 450. 1927; Wangerin in *Just, Bot. Jahresber.* 49 (1): 521. 1928; Freyberg, *Leopold. Ber. Kais. Leopold. Deutsch. Akad. Naturf. Halle* 6: 69—117. 1930; Irvine, *Fl. Gold Coast* xxviii, xlvi, lxvi, & 44. 1930; Benoist, *Arch. Bot. Caen* 5, *Mém.* 1: 259. 1931; Caffas, *Pl. Med. Cuba*, ed. 1, 114. 1932; Fedde in *Just, Bot. Jahresber.* 49 (2): 389. 1932; G. Klein, *Handb. Pflanzenanal.* 2 (1): 359. 1932; Wilder, *Frag. Path* 326. 1932; Benoist, *Bois Guyan. Franç.* 259. 1933; Fedde in *Just, Bot. Jahresber.* 51 (2): 259. 1933; C. S. Sarg., *Man. Trees N. Am.*, ed. 2, imp. 3, 866—867 & [899]. 1933; G. T. Hastings, *Torreya* 34: 157. 1935; J. M. Johnson, *Torreya* 34: 138. 1935; Caffas, *Pl. Med. Cuba*, ed. 2, 114. 1937; Dalz., *Useful Pl. W. Trop. Afr.* 453—454. 1937; Wangerin in *Just, Bot. Jahresber.* 58 (1): 244. 1938; Aces, *Pl. Util. Antill.* 1939; Fedde in *Just, Bot. Jahresber.* 58 (2): 491. 1939; Oertel, *U. S. Dept. Agr. Circ.* 554: 15—16 & 45. 1939; Tharp,

Veg. Tex. 67. 1939; J. H. Davis, Carnegie Inst. Wash. Publ. 517 [Papers Tortugas Lab. 32]: 303—412. 1940; Uphof, Bot. Rev. 7: 1 & 37. 1941; Jacks. in Hook. f. & Jacks., Ind. Kew., imp. 2, 1: 254. 1946; West & Arnold, Nat. Trees Fla. 190. 1946; I. M. Johnst., Sargentia 8: 260. 1949; Parsa, Fl. Iran 4 (1): 536. 1949; C. S. Sarg., Man. Trees N. Am., ed. 2, imp. 4, 2: 866—867 & [899], fig. 765. 1949; Metcalfe & Chalk, Anat. Dicot. 1030 & 1038. 1950; Erdtman, Pollen Morph. & Pl. Tax., ed. 1, 448. 1952; Lamotte, Geol. Soc. Am. Mem. 51: [Cat. Cenoz. Pl. N. Am.] 80. 1952; Penfound, Bot. Rev. 18: 415, 417, 426, 427, 429, 433, 442, & 444. 1952; Arnoldo, Zakfl. 30, 45, 153, & 163, pl. 2, fig. 3. 1954; R. W. Br., Compos. Scient. Words 833. 1954; Roberty, Pet. Fl. Ouest-Afric. 178. 1954; Core, Pl. Tax. 402. 1955; Navalkar, Journ. Bombay Nat. Hist. Soc. 53: 342. 1956; R. Ferreyra, Bol. Soc. Argent. Bot. 6: 198—199 & 201, fig. 3. 1957; Hansford, Sydowia 10: 50. 1957; Cuatrecas., Revist. Acad. Colomb. Cienc. 10: 256 & 257, pl. 27. 1958; Stearn, Kew Bull. 1958: 33—36, fig. 1. 1958; Storer, Familiar Trees & Cult. Pl. Jamaic., imp. 1, 41. 1958; Bascope, Bernardi, Jorgensen, Hueck, Lamprecht, & Martinez E., Mangl. Am. [Inst. Forest. Latinoam. Invest. Capac. Descript. Arb. Forest. 5:], imp. 1, 4—5, 13, 15—17, 28, 29, 32, 33, 41, 42, 45, & 46. 1959; H. F. Bergman, Bot. Rev. 25: 466. 1959; Braga, Pl. Nordest., ed. 2, 348. 1960; Emberger in Chadeaud & Emberger, Trait. Bot. 2: 827 & 831, fig. 1173a & 1178. 1960; Jacks. in Hook. f. & Jacks., Ind. Kew., imp. 3, 1: 254. 1960; J. F. Macbr., Field Mus. Publ. Bot. 13 (5): 721. 1960; Storer, Familiar Trees & Cult. Pl. Jamaic., imp. 2, 41. 1960; Zim, Guide Everglades 50. 1960; Hansford, Sydowia Ann. Myc., ser. 2, Beih. 2: 687. 1961; Navalkar, Trop. Ecol. 2: 90. 1961; C. S. Sarg., Man. Trees N. Am., ed. 2, imp. 5, 2: 865—867 & [899], fig. 765. 1961; Gledhill, Check List Flow. Pl. Sierra Leone 30. 1962; Hartl, Beitr. Biol. Pfl. 37: 303. 1962; Hepper in Hutch. & Dalz., Fl. W. Trop. Afr., ed. 2, 448—449. 1962; Hocking, Excerpt. Bot. A.5: 45. 1962; Townsend, Excerpt. Bot. A.4: 243. 1962; Argo, Nat. Hist. 72 (4): 53—54. 1963; V. E. Graham, Trop. Wild Fls. 112 & 113. 1963; Hocking, Excerpt. Bot. A.6: 524. 1963; Robertson & Gooding, Bot. Caribb. 47, 109, 117, 135, 220, 221, 229, & 230, pl. 2. 1963; Anon., Ind. Bibliogr. Bot. Trop. 1 (1): 40. 1964; Biebl, Protoplasma 59: 133. 1964; R. Good, Geogr. Flow. Pl. 240. 1964; Little & Wadsworth, Common Trees P. R. [U. S. Dept. Agr. Agric. Handb. 249:] 12 & 476—478, fig. 225. 1964; Melchior in Engl., Syllab. Pflanzenfam., ed. 12, 2: 436 & 438, fig. 184 I. 1964; P. W. Richards, Trop. Rain Forest 302, 303, & 306. 1964; Angely, Fl. Anal. Paran., ed. 1, 581. 1965; Biebel & Kinzel, Österr. Bot. Zeitschr. 112: 59, 61, 66, 69, 70, 73, & 88. 1965; Naurois & Roux, Bull. Inst. Fond. Afr. Noire 27: 851. 1965; C. S. Sarg., Man. Trees N. Am., ed. 2, imp. 6, 2: 865—867, [899], 920, & 924, fig. 765. 1965; Altman & Dittmar, Environ. Biol. 95. 1966; Compère, Biol. Abstr. 47: 316. 1966; Erdtman, Pollen Morph. & Pl. Tax., ed. 2, 448. 1966; Giglioli & King, Journ. Appl. Ecol. 3: 1—19. 1966; Kohlmeyer, Bericht. Deutsch. Bot. Gesell. 79: 28, 30, 33, & 36. 1966; Menninger, Fantastic Trees, imp. 1, 22, 261, 262, 288, & 294. 1966; Riegel, Dissert. Abstr. 26: 6648. 1966;

- Rzedowski & McVaugh, *Contrib. Univ. Mich. Herb.* 9: 11, 77, 80, 81, & 107. 1966; D'Arcy, *Rhodora* 69: 438. 1967; Benson & Atkinson, *Biores. Index* 1967: 4442. 1967; Benson & Atkinson, *Fed. Proc.* 26: 394. 1967; deWit, *Pl. World High. Pl.* 2: 186—187, fig. 163. 1967; Ewan, *Southwest La. Journ.* 7: 10, 18, 25, & 57. 1967; P. Gray, *Dict. Biol. Sci.* 315. 1967; Hocking, *Excerpt. Bot. A.12:* 424. 1967; Kohlmeyer, *Icon. Fung. Mar.* 1: Anh. 5, pl. 41a, 46a, 49a, 51a, 61a, 64a, & 65a. 1967; H. B. Lovell, *Biores. Ind.* 1967: 3528. 1967; H. B. Lovell, *Gleaning Bee Cult.* 95: 163—169 & 183. 1967; L. & M. Milne, *Living Pl. World* 173. 1967; Thom., *Journ. Ecol. [Brit.]* 55: 302, 312—329, 332—339, & 342, fig. 7—19 ["A"], pl. 8, ph. 1, 2, & 4, & pl. 9, ph. 5 & 6. 1967; Acosta-Solis, *Divis. Fitogeogr. Ecuad.* 25, pl. 9. 1968; Anon., *Biol. Abstr.* 49 (4): B.A.S.I.C. S. 17 (1968) and 49 (5): B.A.S.I.C. S.153. 1968; Brockman, *Field Guide Trees N. Am.* 262—263. 1968; Croizat, *Trop. Ecol.* 8: 60—61. 1968; Giglioli & King, *Biol. Abstr.* 49: 1874. 1968; Hocking, *Excerpt. Bot. A.12:* 424. 1968; J. Kohlmeyer, *Mycologia* 60: 252, 255—256, 259, 260, 265—266, & 268. 1968; Moldenke, *Biol. Abstr.* 49: 4199. 1968; Moldenke, *Phytologia* 15: 473—475 & 477. 1968; Moldenke, *Résumé Suppl.* 16: 16 & 20 (1968) and 17: [1] & 2. 1968; Pennington & Sarukhán, *Man. Ident. Arb. Trop.* 368—369. 1968; Sick in Fittkau, Illies, Klinge, Schwabe, & Sioli, *Biogeogr. & Ecol. S. Am.* 2 [Van Oye, *Monog. Biol.* 19]: 481. 1968; W. A. Stephens, *South. Seashores* 23, 107, & [189]. 1968; Thom, *Biol. Abstr.* 49: 1975. 1968; Uphof, *Dict. Econ. Pl.*, ed. 2, 60, 77, & 330. 1968; Ambast, *Text-book Pl. Ecol.* 169 & 191. 1969; Coomans, *Malacologia* 9: [Biol. Asp. Mangr. Mollusks] 79—84. 1969; Farnsworth, Blomster, Quimby, & Schermerh., *Lynn Index* 6: 263. 1969; Lamberti, *Contrib. Conhec. Ecol. Pl. Manq. Itanh.* 40, 41, 46, 149, 152, & 165. 1969; Liogier, *Fl. Cub. Supl.* 124. 1969; Little, *Forest Serv. Res. Paper ITF* 9: 3 & 11. 1969; M. Martínez, *Pl. Med. Mex.*, ed. 5, 453. 1969; A. L. Moldenke, *Phytologia* 18: 113 & 399. 1969; Schnetter, *Caldasia* 10: 299 & 300. 1969; Schubert, *Reg. Veget.* 60: 109. 1969; J. & M. Teal, *Life & Death Salt Marsh* 104 & 105. 1969; Anon., *Biores. Index* 6: 4689. 1970; Bascope, Bernardi, Jorgensen, Hueck, Lamprecht, & Martinez E., *Mangl. Am. [Inst. Forest. Latinoam. Invest. Capac. Descrip. Arb. Forest.* 5:], imp. 2, 4—5, 13, 15—17, 28, 29, 32, 33, 41, 42, 45, & 46. 1970; V. J. Chapm., *Trop. Ecol.* 11: [1], 4—9, & 16, fig. 3. 1970; Coomans, *Biol. Aspects Mangr. Mollusks* 79—84. 1970; Correll & Johnston, *Man. Vasc. Pl. Tex. [Contrib. Tex. Res. Found. Bot. 6:]* 23, 1806, & 1843. 1970; Dennis, *Kew Bull. Addit. Ser.* 3: 258. 1970; Gibson, *Fieldiana Bot.* 24 (9): 176—179, fig. 32. 1970; Gill, [Bull.] Fairchild *Trop. Gard.* 25 (3): 7, 10, & 11. 1970; Jenik, *Preslia* 42: 105, 106, 111, & 112. 1970; Kylin & Gee, *Biol. Abstr.* 51: 9038—9039. 1970; Kylin & Gee, *Pl. Physiol.* 45: 169—172. 1970; Moldenke in Correll & Johnston, *Man. Vasc. Pl. Tex. [Contrib. Tex. Res. Found. Bot. 6:]* 1311—1312. 1970; Oberwinkler, *Pterid. & Sperm. Venez.* 32 & 41. 1970; Schofield, *Field Guide Galapagos pl.* 2. 1970; Anon., *Biol. Abstr.* 52 (12): B.A.S.I.C. S.23 & S.153. 1971; Craighead, *Trees S. Fla.* 1: 92. 1971; Dodd & Siemers, *Biol.*

- Abstr. 52: 6585. 1971; Dodd & Siemers, Geol. Soc. Am. Bull. 82: 211--218. 1971; Erdtman, Pollen Morph & Pl. Tax., ed. 3, 448. 1971; Farnsworth, Pharmacog. Titles 6 (9): ii & title 15746. 1971; Gantz, Naturalist South. Fla. 202--205 & 211. 1971; Gill, Forest Sci. 17: 462--465, fig. 1--7. 1971; Hartwell, Lloydia 34: 386. 1971; J. & E. Kohlmeier, Mycologia 63: 838, 843, 844, & 851--853. 1971; Long & Lakela, Fl. Trop. Fla. 18, 732, & 930. 1971; McCusker, Ann. Bot. [London] 35: [707]--708. 1971; C. McMillan, Ecology 52: [927]--930. 1971; Moldenke in Wiggins & Porter, Fl. Galáp. Isls. 275--277. 1971; Sáenz R. & Nassar C., Revist. Biol. Trop. 18: 136. 1971; Wiggins & Porter, Fl. Galap. Isls. 17, 18, 276, 979, 980, & 987, fig. 64, pl. 26. 1971; C. D. Adams, Flow. Pl. Jamaic. 637, 791, 802, & 804. 1972; Alemán Frías, Aurich, Ezcurra Ferrer, Gutiérrez Vázquez, Horstmann, López Rendueles, Rodríguez Graquitená, Roquel Casabella, & Schreiber, Die Kulturpfl. 19: 421. 1972; Anon., Biol. Abstr. 53 (9): B.A.S.I.C. S.23 & S.154 (1972) and 54 (3): B.A.S.I.C. S.23 & S.153. 1972; C. A. Br., Wildfls. La. 154, 236, & 241. 1972; P. Br. in Sloane, Civil & Nat. Hist. Jamaic., ed. 1, imp. 2, 263. 1972; D. S. & H. B. Correll, Aquat. & Wetland Pl. SW. U. S., imp. 1, 1393 & [1394], fig. 653. 1972; Crisan, Excerpt. Bot. A.20: 404. 1972; Dostál, Excerpt. Bot. A.20: 83. 1972; Eliasson, Bot. Notiser 125: 52. 1972; Farnsworth, Pharmacog. Titles 7 (4): iii & 222 (1972) and 7 (10): ii. 1972; Gong, Trojánkova, Trojánek, & Farnsworth, Lloydia 35: 147. 1972; Gill, Biol. Abstr. 54: 1574. 1972; Hueck & Seibert in Walter, Vegetationsmonog. Einz. Gros. 2a: 69. 1972; Lesham & Levison, Oecol. Pl. 7: 174 & 176. 1972; J. F. Lewis, Pl. Prov. Continent. U. S. 69 [mss.]. 1972; C. McMillan, Biol. Abstr. 53: 4760. 1972; Moldenke, Phytologia 23: 416 & 417. 1972; Moore, Miller, Albright, & Tieszen, Photosynthetica 6: 387 & 390--392. 1972; Palmer & Pitman, Trees South. Afr. 3: 1947, 1949, & 1971--1975. 1972; Rouleau, Taxon Index Vols. 1-20 part 1: 42. 1972; Savage, Fla. Dept. Nat. Resour. Mar. Res. Lab. Prof. Paper Ser. 19: 1--46. 1972; Anon., Biol. Abstr. 56 (4): B.A.S.I.C. S.22 (1973) and 56 (11): B.A.S.I.C. S.25, S.156, & S.248. 1973; J. B. Craig, Am. Forests 79 (4): [32]. 1973; Diamond, Condor 75: 200 & 208. 1973; Farnsworth, Pharmacog. Titles 6, Cum. Gen. Ind. [17]. 1973; Hegnauer, Chemotax. Pfl. 6 [Chem. Reihe]: 666. 1973; Howard, Journ. Arnold Arb. 54: 443. 1973; Kylin in W. P. Anderson, Ion Transp. Pl. 371. 1973; Moldenke, Phytologia 25: 225--228. 1973; Moldenke in Woodson, Schery, & al., Ann. Mo. Bot. Gard. 60: 150--154, fig. 1. 1973; Moore, Miller, Albright, & Tieszen, Biol. Abstr. 56: 6392. 1973; Savage, Biol. Abstr. 56 (4): 1996. 1973; Tomlinson & Gill in Meggers, Ayensu, & Duckworth, Trop. For. Ecosyst. Afr. & S. Am. 132, 133, 141, & 142, fig. 4 & 17. 1973; Villiers, Ann. Fac. Sci. Cameroun 14: 3--45. 1973; Villiers in Aubréville & Leroy, Fl. Gabon 22: 64--67, pl. 16. 1973; Farnsworth, Pharmacog. Titles 9 (3): iii. 1974; Fosberg, Proc. Sec. Internat. Coral Reef Sympos. 1: 396. 1974; Gibbs, Chemotax. Flow. Pl. 3: 1753 & 1754 (1974) and 4: 2049. 1974; Hook, Brown, & Wetmore, Bot. Gaz. 133: 445--446. 1974; H. R., Biol. Abstr. 57: 760 & 1904. 1974; J. S. J., Biol. Abstr. 58: 3271. 1974; León & Alain, Fl. Cuba, imp. 2, 2: 323,

fig. 139. 1974; Little, Woodbury, & Wadsworth, *Trees P. R. & Virg. Isls.* 2 [U. S. Dept. Agr. Agric. Handb. 449]: 854, 990, 993, & 1020. 1974; Moldenke, *Phytologia* 28: 432, 434, & 453 (1974) and 29: 75. 1974; A. L. Moldenke, *Phytologia* 28: 504 (1974) and 29: 169. 1974; J. F. Morton, 500 Pl. S. Fla. 29. 1974; Percival, *Biotropica* 6: 105, 106, 108, & 109, fig. 1 G. 1974; Wilder, *Frag. Gard.* 326. 1974; Balgooy, *Pacif. Pl. Areas* 3: 243. 1975; Cloudsey-Thomp., *Terrestr. Environ.* 36--37. 1975; D. S. & H. B. Correll, *Aquat. & Wetland Pl. SW. U. S.*, imp. 2, 2: 1392--[1394], 1741, 1743, & 1759, fig. 653. 1975; [Farnsworth], *Pharmacog. Titles* 7, *Cum. Gen. Ind.* [15]. 1975; Lugo, Evink, Brinson, Broce, & Snedaker in Golley & Medina, *Trop. Ecol. Stud.* [Jacobs, Lange, Olson, & Wieser, *Ecol. Stud.* 11:] 335, 337--339, & 344. 1975; Menninger, *Fantastic Trees*, imp. 2, 22, 261, 262, 288, & 294. 1975; Moldenke, *Phytologia* 30: 15 (1975), 31: 375, 377--384, 387, 391, 393, & 403 (1975), and 32: 361, 364, 365, 367, 369, 437, 438, 454, & 455. 1975; Molina R., *Ceiba* 19: 95. 1975; J. C. & N. C. Roberts, *Field Guide Baja Calif.*, ed. 1, 12, 17, 18, 29, 35, 154, & [155]. 1975.

Additional illustrations: Jacq., *Select. Stirp. Amer. Hist. pl.* 112, fig. 2. 1763; Solered., *Syst. Anat. Dicot.* 713, fig. 151 G. 1399; Huber, *Arboret. Amaz.* pl. 17. 1900; D. H. Scott in Solered., *Syst. Anat. Dicot.* [transl. Boodle & Fritsch] 1: 632, fig. 151 G. 1908. Bakh., *Bull. Jard. Bot. Buitenz.*, ser. 3, 3: pl. 22. 1921; C. S. Sarg., *Man. Trees N. Am.*, ed. 2, imp. 1, 2: 866, fig. 765. 1922; Berry, *U. S. Nat. Mus. Proc.* 66 (21): pl. 3, fig. 1, 2, & 6, & pl. 4, fig. 1. 1925; West & Arnold, *Nat. Trees Fla.* 190. 1946; C. S. Sarg., *Man. Trees N. Am.*, ed. 2, imp. 2, 2: 866, fig. 765. 1949; Arnoldo, *Zakfl. pl.* 2, fig. 3. 1954; Cuatrecas., *Revist. Acad. Colomb. Cienc.* 10: pl. 27. 1958; Storer, *Familiar Trees & Cult. Pl. Jamaic.*, imp. 1, 41. 1958; Bascope, Bernardi, Jorgensen, Hueck, Lamprecht, & Martinez E., *Mangl. Am.* [Inst. Forest. Latinoam. Invest. Capac. Descrip. Arb. Forest. 5:] 12--13 & 42--43. 1959; Emberger in Chadefaud & Emberger, *Trait. Bot.* 2: 827, fig. 1173a. 1960; Storer, *Familiar Trees & Cult. Pl. Jamaic.*, imp. 2, 41. 1960; Zim, *Guide Everglades* 50 [in color]. 1960; C. S. Sarg., *Man. Trees N. Am.*, ed. 2, imp. 3, 2: 866, fig. 765. 1961; V. E. Graham, *Trop. Wild Fls.* 113. 1963; Robertson & Gooding, *Bot. Caribb.* 118--119, pl. 2. 1963; Little & Wadsworth, *Common Trees P. R.* [U. S. Dept. Agr. Agric. Handb. 249:] 477, fig. 225. 1964; Melchior in Engl., *Syllab. Pflanzenfam.*, ed. 12, 436, fig. 184 I. 1964; C. S. Sarg., *Man. Trees N. Am.*, ed. 2, imp. 4, 2: 866, fig. 765. 1965; deWit, *Pl. World High. Pl.* 2: 187, fig. 163. 1967; Thom, *Journ. Ecol.* [Brit.] 55: 331--332, fig. 7--19 ["A"], pl. 8, ph. 1, 2, & 4, & pl. 9. 1967; Acosta-Solis, *Divis. Fitogeogr. Ecuad.* pl. 9. 1968; Brockman, *Field Guide Trees N. Am.* 263. 1968; Pennington & Sarukhán, *Man. Ident. Arb. Trop.* 368 & 369. 1968; M. Martinez, *Pl. Med. Mex.*, ed. 5, 453. 1969; Bascope, Bernardi, Jorgensen, Hueck, Lamprecht, & Martinez E., *Mangl. Am.* [Inst. Forest. Latinoam. Invest. Capac. Descrip. Arb. Forest. 5:] 12--13 & 42--43. 1970; Gibson, *Fieldiana Bot.* 24 (9): 178, fig. 32. 1970; Schofield, *Field Guide Galapagos pl.* 2. 1970;

Craighead, *Trees S. Fla.* 1: 92. 1971; Gill, *Forest Sci.* 17: 462 & 463, fig. 1—4. 1971; Wiggins & Porter, *Fl. Galáp. Isls.* 276, fig. 64, pl. 26 (in color). 1971; C. A. Br., *Wildfls. La.* 154 (in color). 1972; D. S. & H. B. Correll, *Aquat. & Wetland Pl. SW. U. S.*, imp. 1, [1394], fig. 653. 1972; Moldenke in Woodson, Schery, & al., *Ann. Mo. Bot. Gard.* 60: 151, fig. 1. 1973; León & Alain, *Fl. Cuba*, imp. 2, 2: 323, fig. 139. 1974; Percival, *Eiotropica* 6: 106, fig. 1 G. 1974; D. S. & H. B. Correll, *Aquat. & Wetland Pl. SW. U. S.*, imp. 2, 2: [1394], fig. 653. 1975; J. C. & N. C. Roberts, *Field Guide Baja Calif.*, ed. 1, [155] (in color). 1975.

Recent collectors describe this plant as a much-branched shrub or small tree of shrub-like aspect, moderately densely branched, or a spreading, handsome, symmetrical, black-stemmed tree, 2--20 meters tall, the trunk 4--36 inches in diameter at breast height or sometimes only 2--8 cm. in diameter at the base, sometimes with 3 trunks, the bark smoothish and greenish-brown or blackish, light-gray or gray and fissured, or dark-gray and slightly fissured, the roots growing horizontally and sending up small, erect, vertical, slender, abundant pneumatophores, rarely with stilt-roots (Allen 1724) or with "prop-roots and leafless basal shoots" (Webster & Wilbur 3035); leaves firm, light-green or dull-green to very dark-green above, slightly paler or somewhat glaucous beneath when fresh or even white or whitish or appearing silvery beneath, often bearing salt crystals on the surface; flowers fragrant or scarcely so; in inflorescence blackish or black in appearance, stamens brown, anthers black, stigmas and style light-green; fruit flat, green or yellow-green or even red-tinged (Breteler 5174), turning brown. Pennington & Sarukhán K. assert that the "corteza lisa con lenticelas prominentes, moreno oscura!"

The leaves are slightly elongate and conspicuously venose on Fosberg & Spellman 54272 from Belize and very sharp-pointed on Ekman H.14750 from the Dominican Republic. Stearn 287 exhibits some leaves partly gray-tomentellous and partly green-glabrous beneath.

The corollas are usually described as "white" (e.g., P. H. Allen 1724, Brumbach 7904, Crosby 41, DeWolf 1908, Duke 9703, Fedema 2038, Fosberg 42998 & 53970, Fosberg & Spellman 54243, 54343, 54395, 54421, & 54456, Haught 4855, Holdridge 1064, Howard & Howard 10205, Jiménez 1344 & 2561, Killip 43914, Killip & Swallen 40245, Little 13631, Molina R. 8635, Molina R. & Molina 22779, R. V. Moran 9168 & 16666, G. R. Proctor 17932 & 19136, Stearn 287 & 325, Stern & al. 50, Stoddart 461, Wagner 837, and Wedel 987), but were "whitish" on Fosberg & Spellman 54204 & 54272 and Ventura A. 5226, "white, the tube yellow" on Fosberg 41904, "dirty-white, the tube yellow" on Breteler 4673, "cream-white with pale orange-yellow tube" on Fosberg 41866, "white to cream-colored" on Gillis 6809, "cream or white" on Molina R. 23287, "cream" on Beauchamp 2131, Breteler 5174, Correll 45558, Romero-Castafeda 9018, and Spellman & Stoddart 2481, "white with yellow eye" on

Fosberg 48268, "white with yellow markings" on W. D. Stevens 1130, "cream with yellow throat" on Robertson & Austin 310, "creamy-white with yellow center" on A. Carter 2721, "cream-colored with yellow center" on Wilbur & Webster 2525, "off-white" on Spellman & Stoddart 2567, "pale-cream" on Spellman & Stoddart 2157, "cream-white" on Spellman & Stoddart 2498, "lobes white, throat yellow" on Fosberg 48266, "yellow, turning white" on R. A. Howard 4940, "yellow" on Lems 5026 and Silva 163, "yellowish" on D. E. Stone 1974, "yellowish-white" on P. H. Allen 6837, "pale-yellow with darker yellow throat" on Spellman & Stoddart 2225, and "limb pale-yellow with lemon-yellow center" on Webster & Wilbur 3035.

Recent collectors have encountered the plant on sea beaches, the shores of small ponds and secondary lagoons, in water on sandy ocean shores, in coastal marshes and marshy areas, on low sandy peninsulas and tidal flats, in swampy waste areas, salt ponds, and sloughs, on the borders of salt flats, in secondary tropical rainforests among mixed mangroves, in beach vegetation, in depressions on salt rock outcrops, on sand dunes and flats, around small pools on flats of mixed coarse gravel, at the edge of water of lagoons and at the borders of brackish ponds, in mangrove swamps, in sandy mud, on sandy shores, salt flats, and rocky beaches, in halophytic environments in general, often growing with Batis, in very alkaline soil on coral sand planted with Cocos nucifera, and on shingle beaches with Laguncularia, at altitudes of sea-level to 50 meters, flowering from February to June and in August and November, fruiting in February, March, June, August, and September.

Little found the species "common locally on silt shores" in the Virgin Islands, while Box refers to it as "frequent to abundant in all coastal associations, often forming large mangrove swamps on mud flats" on Antigua, where Fosberg found it "abundant on shoreward side of mangrove swamps along bay shores". Proctor says that it forms "occasional thickets along coasts, usually inland from Rhizophora" on Providencia Island; Fosberg describes it as "very local" or "locally abundant around small ponds in coral sand and fine gravel" on Alacran Atoll and "common around margins of saline ponds separated from the sea by low sandy beach ridges" on St. Croix. Thomas reports it "common in sandy soil of shore among mangroves, Salicornia, Batis, and Maytenus phyllanthoides", while Hastings encountered it "in mangrove swamp and adjacent flats associated with Maytenus phyllanthoides, Rhizophora mangle, and Batis maritima".

R. M. Beauchamp, in a letter to me dated February 7, 1976, reports that he found A. germinans on Punta Edie island, "a strand island northwest of San Carlos at the north end of Bahia Magdalena, Baja California Sur. The plants were growing in the Mangrove Scrub with Laguncularia racemosa and Rhizophora mangle. You might be interested in the fact that these latter two species grow as far north as San Ignacio Lagoon, also on the Pacific

Coast of Baja California. I did not see any specimens of A. germinans [there] however. In the Gulf of California the Mangrove-type plants occur farther north due to the warmer water and air temperature."

Roberts (1975) assures us, again, that the "Seeds may sprout while on the tree then fall and float until they find a suitable place to grow. Black mangrove grows [in Baja California] with Rhizophora (red mangrove) and Laguncularia (white mangrove) in lagoons, bays and estuaries from Mulegé and Bahía Magdalena south along both coasts. Black mangrove does not grow on stilt-like stems with prop roots like the red mangrove, but sends rootlets up above water to 'breathe'".

Tharp asserts that Avicennia germinans is found only in the coastal prairie region of Texas, where Hildebrand & Johnston found it "very abundant in [the] Borrchia-Batis-Monanthochloë association" and Traverse reports it from the "edge of [a] small slough in [the] Monanthochloë-Borrchia frutescens complex". In Nayarit it is "occasional in mangrove swamps" according to Stevens & Fairhurst; Ventura A. reports it "abundant" in Veracruz while Stevens found it a "common tree on [the] inland side of dry beach with no standing water at this season". In Baja California it is said by Thomas to be "common with Salicornia, Batis, and Maytenus phyllanthoides" and by Carter "abundant on low dunes". In the same region Hastings encountered it in a "swamp with Maytenus phyllanthoides, Rhizophora mangle, and Batis maritima", while he and Turner found it associated with Rhizophora mangle and Salicornia ambigua. Long and his associates encountered it "in sandy beach area grading into interior depression with mangrove, especially Conocarpus and Rhizophora — Chamaesyce mesembryanthemifolia found frequently along beach" on Content Key, while Gentry reports it from the "mangrove area surrounded by coconut forest, soil varies from sandy to mucky" on San Andres Island. Allen reports it the "dominant species" or "fairly frequent" in El Salvador, and Lems, in Costa Rica, encountered it "in mangrove swamps with Rhizophora, Laguncularia, and Pelliciera, the dune ridges with cactus, Ipomoea, and legume scrub". In Antioquia Feddes reports it a "not common tree", while Haught found it "very abundant on sandy soil near the sea". Fosberg reports it "rare at edge of mangroves", while in Ecuador it is said by Játiva & Epling to be the "dominant tree in mangrove swamps" [but this statement undoubtedly applies to var. guayaquilensis rather than the typical form of the species].

Harris & Lawrence C.159 & C.15546 were used for osmotic pressure studies in 1915; Wedel 987 is a mixture with an epiphyte and Stern 1478 shows abundant salt crystals on the leaf-surface. Killip 40946 is accompanied by an in situ photograph mounted on the sheet.

Erdtman (1952) reports that the pollen grains of A. germinans are 39 x 29 μ in size, with the sexine considerably thicker

than the nexine, while in A. africana — with which this species is often united — they are only 32 x 26 μ , with the sexine as thick as the nexine. Unfortunately, he does not say from what specimens his pollen samples of A. germinans came — if they came from the typical form of the species from Florida or the northern West Indies and Mexico or if they came, instead, from var. guayaquilensis or from some of the other taxa on the northeast coast of South America, would be most valuable facts to know. It is most unfortunate that so many botanists other than taxonomists so often fail to realize the importance of keeping herbarium vouchers to back up their statements or, at least, to cite the precise source of their material.

Craig (1973) reports the American Forestry Association's "Social Register of Big Trees" lists a tree of A. germinans on Sanibel Island, Florida, which is 50 feet tall, with a 35-foot spread and the trunk 5 feet 10 inches in circumference at 4 1/2 feet above its base. Chapman (1944) describes five kinds of roots produced by this species: primary adventitious, horizontal, anchoring, absorbing, and pneumatophores. Allen has found prop-roots on some specimens. West & Arnold (1946) describe the tree as attaining a height of 60 feet, the trunk sometimes "about 2 feet in diameter, but usually much smaller", the crown "round-topped, composed of spreading branches, from very short trunks", the bark "dark brown, thick, roughened with small, thin, irregular, appressed scales", the twigs "gray, stout, smooth, rigid, enlarged at the joints", the leaves "persistent, opposite, simple, leathery, yellow green to dark green above, pale and downy beneath, 2 to 4 inches long, narrowly elliptic, with rounded or pointed tips, wedge-shaped bases, and entire margins", the flowers blooming "all year, white, about 1/2 inch in diameter, all parts of the flower clusters except the flowers themselves very downy, in dense, conical heads at ends of new growth", the fruit "ripening all year, green, downy, ovate but with unequal sides, flattened, 1 inch or more long", and the seeds "single, flat, filling the fruit". This is a good description of the typical northern form of the species. They assert that in Florida it "grows in abundance in coastal hammocks and on shore-lines of the peninsula from St. Johns and Levy counties southward. Its complicated root system retains much of the debris deposited by high tides; as a result, later accumulations of sand soon form small islands. The flowers are so rich in nectar attractive to bees that some beekeepers specialize in this kind of honey. During June and July, when bloom is most profuse, hives are carried to the vicinity of dense stands along the seacoast, in order that the bees may harvest the nectar and produce a clear, white honey with a characteristic flavor."

In this connection the situation along the northeastern coast of Brazil, as described by Freyberg (1930), should be noted. Here "niemals ist die Landbildung von der Mangrove voranlasst; diese besiedelt und befestigt vielmehr nur bereits gebildetes Land und beteiligt sich lediglich an der Erhöhung von Bänken, die durch

rein anorganische Sedimentationsvorgänge schon gebildet sind, und zwar höchstens um eine Mächtigkeit, die dem Tidenhub entspricht, wenn nicht eine gleichzeitige langsame Senkung eintritt. Der Gleithang zeigt ein charakteristisches, immer wiederkehrendes Profil: an den hochstämmigen Mangrovwald, der ziemlich licht ist und im wesentlichen nur aus Rhizophora Mangle, Avicennia nitida und Laguncularia racemosa besteht, schliesst sich in allmählichen Übergang ein Mangrovebusch, der immer kleinere Individuen aufweist und schliessnackte Schlamm- oder Schlickbank heraustreten kann. So stellt sich am Gleithang die Mangrove als ein vom Wasser her langsam aufsteigender geschlossener Wall dar, durch den kein Stamm und grösserer Ast sichtbar wirt; am Prallhang (Abtragungsrand) dagegen wird an den Erosionsstellen der Schlick aus dem dichten Wurzelfilz, in welchem sich unten die Stelzwurzeln fortsetzen, herausgepült, der Baum stirbt ab und stürzt, so dass das Wasser unmittelbar an die hohen Stämme angrenzt. Die Mangrove ist also nicht nur kein Landbildner, sie kann auch die Zerstörung eines Gebietes, das in den Erosionsbereich gelangt, nicht oder nur in sehr begrenztem Masse verhindern."

Little (1969) says "Tree 30 inches high and 1--1 1/2 feet d.b.h.", but obviously this must be a case of typographic error for "30 feet". Romero comments: "Arbol de 15 m. de alto; tronco gris, muy poco estriado, int. es crema y se observan claramente las capas que la forman. Corola crema, vellosa; porción libre espato-obovada; el int. del tubo es amarillo; 4 pétalos. - 4 anteras, cremas-grises, biloculares, dehisc. introrsa, basifijas, ovadas, algo comprimidas. - Estilo crema, teretado, desde la base de los filets hasta la 1/2 son amarillos. Estigma bifido, verdusco. Estilo vellosa en la mitad, desde la base al centro. Ovario glabro, verde y vellosa. Disco de color salmón, 1 bráctea basilar; 2 brácteas infracal. opuestas y 5 sépalos, todos de color verde, vellosos. El eje de la infl. verde-fálido y velludo. Hojas terminales, opuestas, decusadas; nervio medio amarillo en ambas caras y saliente en el envés; éste menos verde que el haz; pecíolo envainado; elíptico-oblongo."

Cloudsey-Thompson (1975) comments that "Mangrove is characteristic of muddy tropical sea-shores. The term is used to describe a group of woody plants inhabiting tidal lands in the tropics. Mangroves form a good example of convergent evolution because, although they have a number of marked structural characteristics in common, they belong to widely different families of plants. They all have thick, leathery, evergreen leaves of simple shape. Some have prop-roots high up on the stem and often breathing roots also, with minute lenticels through which air diffuses, sticking up vertically from the surface of the mud. They also have a tendency for their seeds to germinate while still attached to the parent plants. The radicles grow straight downwards so that they are driven into the mud when the seeds fall." The West African mangroves all have South American affinities, while those of East Africa and Madagascar have Asian affinities. "Nevertheless all mangrove swamps look alike and take the form of dense, evergreen forests of medium-sized trees with bright green, glossy leaves...

Mangroves often extend in brackish swamps and lagoons for some distance inland, forming a fairly continuous fringe, or occupying islets between which run sluggish tidal streams, for brackish or occasional salt water is necessary for their development. Compared with the rain-forest behind it, the mangrove swamp is a light and airy place. The trade winds from the sea blow through it and the sunshine can enter."

Jenik (1970) avers that in Avicennia germinans (but he is probably referring to A. africana) "only young root-tips and slender distal rootlets spontaneously penetrate above the ground, where they are readily modified into the pneumathodes. The pneumathodes of L[aguncularia] racemosa", on the other hand, are upright or creeping organs, behind the apex of which the cortex is transformed into the white, mealy-like tissue composed of loose cells. The decaying pneumathodes are successively substituted by new crops of aerial rootlets arising from the top of a subterranean peg-root which has the function of a pneumatophore."

Tomlinson & Gill (1973) tell us that the stem growth in both Avicennia and Laguncularia is of the simple type seen in temperate trees like Fraxinus, "but the shoot may approach the articulate type (in South Florida) in that one short internode may mark the position of the shoot apex during winter, which is a period of slower growth. During this season, branch production is at a minimum and this contrasts with a maximum of branch production in summer when shoots are most active.....If shoots are able to maintain high vigor throughout the year then branches may form at every node. This has been observed on vigorous stump sprouts.... A special example is provided by Avicennia which has pronounced growth rings, although these are anomalous because they result from concentric bands of internal phloem produced by successive cambia. Results.....show that up to six rings can be formed in any one year depending on the vigor of a shoot. Consequently ring number is correlated with diameter rather than age....The fact that Avicennia must have nonannual rings can be demonstrated by simple examination of its shoot system, something which never appears to have been done before. This example, although it represents an admittedly specialized type, is useful in demonstrating a situation for which knowledge of temperate trees provides no guidance; it may even, in fact, mislead an observer with limited facilities." The same general theme is summarized by Gill (1971) when he says "Growth rings in Avicennia germinans (L.) Stearn are 'anomalous' in that each consists of xylem, phloem, and conjunctive tissue. The number of rings present in a stem section is related to its diameter but, within sections of the same age, ring number varies. An endogenous control of growth-ring development is suggested."

Detailed descriptions of the anatomical characters of the wood of this species are given by Bascope and his associates (1959): "Vasos distribuidos en múltiples radiales presentes o ausentes. Perforaciones simples, 30--65, algunas veces 65--125, poros por 10 mm². Tamaño de los poros (diámetro tangencial) hasta 0,05 mm.,

algunas veces 0,05—0,10 mm., desde muy pequeños a moderadamente pequeños. Poros invisibles, algunas veces casi visibles a simple vista (tamaño de la Línea 2, algunos veces 3, de poros en la escala transparente). Tejido blanco (parénquima) algunas veces ausente o indistinguible con lupa, predominantemente asociado con los poros, rodeando a los poros (vasicéntrico).

"Floema incluido en hileras tangenciales asociado con bandas concéntricas de tejido anómalo conjuntivo. Anchura de los radios menos de 0,05 mm; finos (tamaño de la Línea 3 de rays en la escala transparente). Radios heterogéneo con varias hileras de células marginales, 25--50, 50--80 radios en 5 mm. (observandos en sección transversal cruzando perpendicularmente a los radios la Línea de 5 mm. en la escala transparente). Color pardo grisáceo, pardo oscuro, casi negro con rayas alternas oscuras y claras. Madura muy pesada y dura, se hunde en el agua. Anillos de crecimiento presentes.....

"Anillos de crecimiento distinguibles causados por bandas alternas de tejido conjuntivo y madera. Vasos casi invisibles a simple vista, generalmente en grupos radiales de 2--8, en hileras radiales distinguibles; diámetro tangencial 57 μ a 14,3 μ , promedio 86 μ ; lúmenes algunas veces con depósitos amarillos (lapachol); perforaciones simples; punteaduras alternas, promedio diametral 3 μ . Fibras en paste septadas con punteaduras simples. Parénquima vasicéntrico 2--3 células en anchura, ocasionalmente algo aliforme. Radios invisibles a simple vista en las secciones transversal y tangencial, inconspicuos en la radial; heterogéneos tipo I, tipo II y tipo III; 1--6, generalmente 2--4 células en anchura; lúmenes con cristales y goma oscura. Estructura en pisos ausente. Canales gomíferos ausentes. Floema incluido, parecido a canales gomíferos."

Thom (1967) states that "Monospecific zones of *Avicennia nitida* occur on low levees and mudflats [in Tabasco, Mexico]. With other mangroves there is formed a tall mixed forest in broad intertributary basins, ecologically reflecting habitat change induced by continually changing, geomorphic processes. Subsidence in the mangrove region facilitates peat development, the spread of mangrove inland, and the enlargement of lagoons. The process will cease when the distributary outlets return to the mangrove region with the result that freshwater plants will invade the mangrove community and new landforms colonized by plants less tolerant of saline conditions, will be initiated."

Bergman (1959) reports that the soft, spongy, radical roots of *A. germinans* are embedded in mud that has been found to be completely free of oxygen; the lenticels on the pneumatophores, especially numerous toward their apex, provide a passageway for the exchange of air between the external atmosphere and the radial roots often with 15--18 percent oxygen concentration. Roots in deeper water have less oxygen." Storer (1960) notes that when germinating seeds fall to the water the large cotyledons keep them afloat and help to distribute them along the shore line.

Penfound (1952) asserts that on the coastal plain of the south-

eastern United States this tree invades the upper edge of salt-water swamps as soil is built. It occupies the Buttonwood Consocieties along with Conocarpus erecta and Sabal palmetto. From Louisiana southward it forms an important Consocieties with Spartina alterniflora in zonal saltwater marshes. As it goes southward it replaces the saltgrass, Distichlis spicata, by cutting out the needed light. It is also found on flooded coastal prairies distinct from the everglades. Eliasson (1972) reports it from areas where Laguncularia racemosa and Rhizophora mangle are the dominants. Chapman (1970) proposes an ecologic association, the Avicennietum nitidae. The Corrells (1972), in their work on the aquatic plants of the southwestern United States, assert that in that area it is found "In mangrove lagoons and along tidal shores" in southeastern and southern Texas, that it is a "very variable" species ranging from Florida and Texas, Bermuda, the Bahama Islands, and both coasts of Mexico, through the West Indies and Central America, to the coasts of Brazil and Peru. It is, however, my opinion now that the populations in the southernmost portions of this stated range represent separate, although closely related, taxa. The Corrells make the very interesting comment that "The fruits of the red mangrove, Rhizophora mangle..... of southern Florida and tropical America, are commonly washed ashore (especially near the mouth of the Rio Grande), where they have been known to sprout, but no living plant has apparently thus far become established in Texas. This species grows in habitats similar to those of the black mangrove but it is readily distinguished from that species by its aerial roots that arise from its trunk and branches, a regular corolla, and the development of a conspicuous radicle to several decimeters in length."

Treub (1883) has shown that Avicennia has "extra-ovulare albumen like Rhizophora". He asserts that it usually grows inshore from the other mangroves, only submerged at high tide and not reached by the daily tides at all, stretching "above their dark green leaves its silvery white and light green leaves". He asserts that "at some places, however, Avicennia grows out in fairly deep water and produces its large area of apogeotropic slender yellowish-brown aërating roots also". He records it from Mangrove Island, Crawfish Key and Ragged Key, Florida. Campos & Lampe refer to it as an "arbol desde 2--10 mts. de altura o más, formando espesa y casi impenetrable vegetación costanera. Creciendo en lugares fangosos, con numerosísimos neumatóforos. Las semillas perminan directamente en el agua."

Percival (1974) refers to the flowers of this tree as a "medium cup", with anthesis lasting more than a single day, pollen and nectar furnished as "animal food" and present in each flower, the nectar composed of 25 percent sugar, the depth of the nectary in the flower 3--8 mm., the pollen consistency tacky, the pollination gap 1 mm., the stigmas held below the level of the anthers, 4 seeds produced per fruit, and only honeybees (Apis mellifica) and no native insects observed at the flowers. Her claim of four

seeds per fruit is interesting.

Johnston (1949) records A. germinans from San José Island, Panama; Hooker (1847) records it [as "A. tomentosa L."] from the Galápagos; Schnetter (1969) lists it from Salamanca Island (Magdalena, Colombia), while Arnaldo (1954) found it on Curaçao and Bonaire. Macbride (1960) cites only Raimondi s.n. from Tumbes, Peru, but gives the overall distribution as "Warm American coasts to Florida and Texas". He regards as synonyms: Bontia germinans L., A. nitida Jacq., A. tomentosa Jacq., and A. tomentosa var. guayaquilensis H.B.K. (the last-mentioned I regard as varietally distinct and it is the Peruvian form).

Adams (1972) asserts that in Jamaica it is "Common in all saline and brackish communities around the coast and on the cays, near sealevel", flowering there from November to August and fruiting in November and December. He cites Adams 8824, Harris 8190, Proctor 24214, and Stearn 287, giving its overall distribution as "Coasts of the American subtropics and tropics from Florida to Brazil, Ecuador, Peru & W[est] Afr[ica]". However, I regard the west African population as A. africana P. Beauv. and the South American populations as mixtures with A. elliptica Holm, A. elliptica var. martii Moldenke, and A. germinans vars. cumanensis & guayaquilensis (H.B.K.) Moldenke. The record by Braga (1960) from Ceará, Brazil, is, therefore, probably erroneous.

Little and his associates (1974) record A. germinans from Puerto Rico, Jost van Dyke, Virgin Gorda, and Buck Island Reef; Romans (1775) records it from the Chandeleur Islands of Louisiana, while Asprey & Robbins (1953) record it from Drunkenman's, Gun, & South East cays. Gooding, Loveless, & Proctor (1965) note that A. germinans was recorded by me in 1959 from Barbados "but possibly confused with the following species [A. schaueriana Stapf & Leechman]" -- with this statement I agree, since I actually have no recorded annotation of an A. germinans specimen from Barbados.

Sargent (1922) summarizes the distribution of A. germinans as known to him as interpreted by him as "Florida, St. Augustine to the southern keys on the east coast, and from Cedar Keys to Cape Sable on the west coast; on some of the islands in Mississippi Sound, and on the shore of Terrebonne and Cameron Parishes, and on most of their islands, Louisiana; on the Bahama Islands, on many of the Antilles, and southward to Brazil; and on the west coast of Africa; in the United States of its largest size in Florida just north of Cape Sable; north of Matanzas Inlet on the east coast of Florida usually with stems only a few feet tall." Berry (1925) records it from the Pleistocene of Trinidad.

Vernacular names recorded for A. germinans are many and include "black mango", "black-mangrove", "black mangrove", "blackwood bush", "comedero", "honey mangrove", "iguanero", "mangle blanco", "mangle iguanero", "mangle negro", "mangle prieto", "mangle pullequi", "mangle salado", "mangle senico",

"mangue branco", "mangue canoé", "manguel blancu", "olive mangrove", "olive mangrove tree", "pale de sal", "palo de sal", "puyequé", "salt-pond-tree", "sietecapas", "siete-capas", "siete capas", "siriuba", and "white mangrove".

Peckolt (1904) reports the following for what he calls "Avicennia nitida" from the coastal states of Brazil, but is undoubtedly referring here to the taxon we now call A. elliptica: "Am Litoral aller Küstenstaaten. Indianische Benennungen: Cere-ibuna — Schwarze Frucht, Cere-itinga — Weisse Frucht, von den Portugiesen korrumpiert in Ciriúba, Siriúba, Xiriúba. In den verschiedenen Staaten hat diese Pflanze noch folgende Volksnamen: Canoes — Bootsholz, Mangue amarella — Gelber Sumpfbaum, Manguae branca — Weisser Sumpfbaum. Baum mit länglich-lanzettlichen, spitzen, glänzend grünen Blättern. Die frischen Blätter gestossen als Umschlag bei Geschwüren. Die Rinde als Adstringens und zum Gerben. Die Fischer und Negerinnen benutzen sie zum Schwarzfärben baumwollener Zeuge, welche in einem Dekokte eingeweicht, dann mit der roten eisenoxydhaltigen Erde gemischt und nach 12 Stunden gewaschen werden. Die feste Holz dient zu Bauen. Nach Rebouças spez. Gew. = 1,114."

For what he calls "Avicennia tomentosa" he reports the following, and here he is probably referring to A. schaueriana in the statements that refer to the northeastern coasts of Brazil: "Kosmopolit aller tropischen Küsten Amerikas. Indianische Benennungen: Ceri, Cere-iba, Ciriba, Ciriába. Volksname: Mangue-siriba. Baum bis 9 m hoch, sehr oft strauchartig, verbreitet sich auf gleiche Weise wie der stete Begleiter in salzhaltigen Sümpfen, Rhizophora Mangle. Blätter verkehrt eiförmig-elliptisch, unterseits weissfilzig. Blüten weiss. Blätter und Rinde als Adstringens, zum Schwarzfärben baumwollener Zeuge, beliebtes Gerbmateriale. Die schwammig-porösen, saftreichen Wurzeln dienen zur Bereitung eines Extraktes, welches als Pflaster bei Schuppenflechte angewandt wird."

Further in regard to the native uses of A. germinans, Castañeda says "tiene una resina que irrita los ojos al aserrarlo". Pennington & Sarukhán (1968) report that in Mexico the species is found on both coasts from Tamaulipas to Yucatán and from Baja California and Sonora to Chiapas and "No se conocen usos industriales de su madera. Localmente es usado para postes y para fabricar carbón". León & Alain (1974) report that in Cuba the "Madera dura y resistente, empleada en horconaduras, diques, muebles y construcciones navales, por ser muy resistente a la acción del agua de mar. Flores melíferas." Argo (1963) claims that it is "less spectacular" than Rhizophora, produces abundant nectar with high levulose content and therefore crystallizing more slowly, and occurs farther north on the east coast of Florida than Rhizophora, indicating a greater hardiness.

Smith (1882) says of what he calls "A. tomentosa": "It is, like the true Mangrove, remarkable for extending its domain seawards by strong roots, which rise out of the mud in an arched, entangled

manner, again entering the mud and sending up asparagus-like shoots, forming extensive, impenetrable jungles. On the American coasts these jungles are the resort and home of alligators." This is not true — alligators usually live in fresh water — it is the American crocodile that is typical of mangrove swamps. Smith's description of the roots, also, is inaccurate — being apparently a mixup of Avicennia and Rhizophora characters.

Palmer & Pitman (1972), in speaking of A. marina (Forsk.) Vierh., report that "It has fragrant flowers reminiscent of those of a famous relative, the honey mangrove — Avicennia nitida Jacq. -- of Florida, Texas, and tropical America, which has scented flowers so much loved by bees that beekeepers from inland areas move their apiaries to them in the blooming season." Gibson (1970) says that "This is one of the plants that characterize most tropical seashores. In Guatemala it is one of the most abundant trees of coastal swamps. The long, heavy roots grow in entangled arches, making almost impassable obstructions, and send to the surface of the mud large masses of irregular asparagus-like aerial roots. The seeds usually germinate on the tree and are growing and ready to take root when they fall into the tidal mud. The flowers are said to be much visited by bees and to supply a good grade of honey." Hartwell (1971) states that this plant's "resin" is used as an ointment or unguent in the treatment of tumors in Cuba, the Antilles, and "Philippines" -- the last statement, on the authority of Roig y Mesa (1945), cannot refer to this species, which does not occur in the Philippines, but probably applies to A. officinalis L.

Diamond (1973) reports that the magnificent frigatebird (Fregata magnificens) in the Galápagos Islands normally nests on the top of low bushes of A. germinans [actually var. guayaquilensis] where this occurs in a continuous fringe along the lagoon shores or in isolated clumps separated by areas of Batis, Sesuvium, and bare mud subject to periodic inundation. These nests occur in a density of 0.28--1.3 nests per square meter. The related F. minor nests in the same habitat on other islands of the group in a density of 0.06 and F. aquila in a density of 0.11--0.5 nests per square meter.

Gibbs (1974) reports that the HCl/methanol test gives negative results in A. germinans and the juglone test in the bark is also negative. Moore and his associates (1972) measured the net photosynthesis, dark respiration, and transpiration rates, as well as the CO₂ compensation concentrations in A. germinans as compared with Rhizophora mangle and Laguncularia racemosa in southern Florida during the winter. Variability was found to be quite high among different plants of all 3 species. Rhizophora, which tended to be the most variable in response to changing light and temperature conditions, had the lowest photosynthetic rates and the lowest temperature optimum. Laguncularia exhibited the highest photosynthetic rates. Both Avicennia and Laguncularia showed

lower resistances to water vapor and CO_2 exchanges than did Rhizophora throughout most of the light and temperature ranges studied.

Savage (1972) reports that, based upon its broad latitudinal range, tolerance of adverse soil conditions, extensive early root system, and ease of transplanting, Avicennia germinans holds the greatest promise for use as a shoreline stabilizer in Florida. "Furthermore, it is at least as important as Rhizophora mangle, the red mangrove, in natural shoreline protection."

D'Arcy (1967) informs us that A. germinans is "occasional" in the coastal thickets of Tortola. Thom (1967) reports that in Tabasco, Mexico, it shows a marked preference for higher and drier habitats than does Rhizophora, and that the redox potential measurements of the top 50 cm. of soil at typical Avicennia sites indicate a marked oxidation, whereas reduced soils are characteristic of the Rhizophora zones. Johnston describes it as a tree 10--12 feet tall and encountered it on shingle beaches with Laguncularia on San José Island, describing its leaves as light-green and slightly paler beneath when fresh. Lamberti (1969) states that Avicennia germinans does not accommodate itself as well to acid pH conditions as does Rhizophora mangle. He further asserts that it often follows after Acrostichum aureum in ecologic succession. He synonymizes A. tomentosa Jacq. with A. schaueriana.

Gill (1970) reports that "workers from Scripps Institute of Oceanography.....have shown that the pencil-like pneumatophores of the local black mangrove (Avicennia germinans), and the arching aerial roots of red mangrove (Rhizophora mangle) do perform an essential role in the aeration of subterranean roots". Hook and his associates (1974) remind us that oxygen entry through stomata and lenticels in the aerial portion is common to all plants. Hydrophytes, including Avicennia, however, are distinguished by having roots adapted to inundation, roots tolerant of high CO_2 concentrations characteristic of flooded soils, and extensive intercellular spaces in cambial ray initials permitting gas exchange across cambium to xylem. Roots in hydrophytes receive what aeration they get through direct exchange across the cambium. In non-hydrophytes the transpirational stream is high in O_2 , but in hydrophytes, like Avicennia, there is little O_2 available to enter it.

Kylin & Gee (1970) report that homogenates from the salt-secreting leaves of Avicennia germinans were subjected to differential centrifugation and then investigated for ATPase. At pH 6.75 a salt stimulation with peaks at 3 different Na and K ratios could be demonstrated above the activity due to Mg^{2+} ions. The stimulation by Na and K depends on the ionic strength of the test medium, higher salt concentrations being inhibitory. The plant system seems, thus, to be more complicated than in animal activities. Technically, this means that a search for $(\text{Na}^+ \& \text{K}^+)$ -activated ATPases in plants should be performed with a close spac-

ing of the Na:K ratios at several constant levels of salt. The transport of Na^+ and K^+ indicates that the physiological situation is rather complex, at least in this plant.

McMillan (1971) found that salinity is not the chief factor limiting seedling establishment of this species in Texan waters, because seedlings rooted in distilled water and in salinities approaching twice the concentration of sea water. Water turbulence, either of distilled or of sea water, inhibited root and seedling development. Seedlings tumbled for as much as 12 weeks showed rapid root development when subsequently stabilized. Various water depths promoted extensive root systems, but seedlings did not become established until water depth was reduced to 5 cm. or less. High temperature treatment, exposure to 39--40°C. for 48 hours, was lethal to stemless seedlings, but not to seedlings with stems and roots. The results of these experiments suggest that the viviparous development in this Texas population, at least, is probably phenologically timed by environmental relations during winter and early spring as a protection against the lethal effects of the high temperatures that prevail on beaches and in shallow water during the late spring and summer.

While the Avicennia tomentosa of Jacquin is rather uniformly regarded by American authors as synonymous with A. nitida Jacq. and therefore of A. germinans (L.) L., many Old World authors do not so regard it. The "Avicennia tomentosa" of Harvey (1838), for instance, is certainly A. marina (Forsk.) Vierh. Biebl (1964), as well as Altman & Dittmer (1966), give A. nitida Jacq. as a synonym of the east African A. marina, a disposition with which I cannot possibly agree, although I suppose that it is a to-be-expected step further from the relegation of it as conspecific with the west African A. africana P. Beauv. The east and west African plants are actually very different and very distinct, the former having Asian and Arabian affinities and the latter American affinities. In this connection the comments of Kuntze (1891) are of interest: "Herzförmige Blätter habe ich nicht gesehen; es muss da Jacquin, der l. c. (Jacq. am. t. 112 f. 1) von A. tomentosa nur 1 Blatt abbildet, das ganz gewiss nicht zu Avicennia gehört, ein Irrthum passirt sein. Die pulverförmige Behaarung fehlt auch den sogenannten kahlen Formen nicht; nur muss man die Lupe zu Hilfe nehmen, um sie zu erkennen, wenn sie schwächer auftritt. Die Griffelmerkmale, wonach Schauer in DC. 4 Arten unterschied, sind schwankend und von neueren Autorum mit Recht nicht mehr berücksichtigt. S. Kurz beschreibt Av. tomentosa auct. auch aus Asien mit langen Griffeln; in Westindien sind offenbar die etwas längeren Griffel vorherrschend. Die Blütenfarbe ändert ebenso wie die Behaarung von weisslich bis ockergelb; dock ist dies weder unter sich, noch mit gewissen Blattvarietäten correlativ." He synonymizes A. africana "Beauv. non Schauer" with A. officinalis α nitida (Jacq.) Kuntze. His A. officinalis β lanceolata Kuntze is probably A. germinans var. guayaquilensis (H.E.K.) Moldenke; γ ovatifolia Kuntze is probably A. marina (Forsk.) Vierh.; δ spath-

ulata Kuntze and ♂ spathulata f. tomentosa are probably A. lanata Ridl.; and ♂ spathulata f. glandulosa Kuntze is probably A. marina var. resinifera (Forst.) Bakh. His A. spicata is what we now call A. alba Blume.

Browne (1755), in his description of "The Olive Mangrove Tree", describes the plant as "Bontia? l. Foliis integris oblongis oppositis, petiolis crassis brevissimis sub amplexantibus, floribus racemosis" and his phrase "petiolis....sub amplexantibus" is most perplexing, since it definitely does not apply to the leaves of A. germinans, yet experts on the West Indian flora have usually regarded the synonymy which he cites, "Mangle lauro-cerasi foliis, flore albo tetrapetalo Slo. Cat. 156. & H. ii. p. 66, 7", as a true synonym of Avicennia germinans. His further description seems quite apt: "Periantium Polyphyllum imbricatum, foliolis subrotundis. Corolla Monopetala quasi personata; tubus brevis cylindraceus; limbus quadripartitus, inaequaliter sectus; laciniis patentibus ovatis. Stamina. Filamenta quatuor tubo longiora; (horum duo paulo breviora sunt;) antherae bilobae subrotundae. Pistillum. Germen oblongum ovatum; stylus brevis subulatus; stigma acutum, quandoque bifidum. Pericarpium. Capsula coriacea, compressa, subrhombaea, oblique elongata, unilocularis. Semen. Unicum quadrilobum germinans, lobis foliaceis. This tree is frequent near the sea, both on the north and south side of Jamaica; and remarkable on account of its ineritious colour, and the narrow form of its leaves. It grows in a low moist ground, and rises commonly to the height of fifteen or eighteen feet. Its capsules are compressed, and obliquely lengthened; and contain each a compressed foliaceous seed, that swells and germinates before it falls."

Schubert (1969), in accepting Avicennia germinans (L.) L., Sp. Pl., ed. 3, 891. 1764, as the proper scientific name and reference for this species, says "Basionym: Bontia germinans Linnaeus, Syst. Nat. ed. 10. 2: 1122. 1759. This combination was nomenclaturally superfluous when published since it included Avicennia officinalis Linn. 1753 (the Asiatic mangrove). However, according to Art. 63, Note, since the American mangrove is considered to be specifically distinct from the Asiatic, the name A. germinans is the correct name [for it]."

In the Bailey Hortorium herbarium there is deposited a photograph of sheet 813.2 in the Linnean Herbarium at the Linnean Society headquarters in London. In Savage's catalogue of the Linnean herbarium this is listed as "Avicennia Br. [Sol.: illegible annot.] descr." and it would seem that this is the type specimen.

Burman (1768) was apparently one of the first to confuse the American and Asiatic plants and unite them under one name (as Linnaeus himself did in 1764). Burman's complete synonymy and notations are as follows: "BONTIA (germinans) foliis oppositis, pedunculis spicatis. Linn. sp. 891. Bontia foliis subtus tomentosis. Jacq. amer. 25. Bontia foliis integris oblongis oppositis, petiolis crassis brevissimis subamplexicaulibus, floribus racemosis.

Brown. jam. 263. Avicennia. Linn. Fl. zeyl. 57. Mat. med. 42. Mangle laurocerasi foliis, flore albo tetrapetalo. Sloan. hist. jam. 2. p. 66. Raj. dendr. 115. Anacardium. Bauh. pin. 511. orientale. Plukn. alm. 28. Arbor indica, fructu conoide, cortice pulvinato, nucleum unicum nullo ossiculo tecto claudente. Raj. hist. 1566. Oepata. Rheed. mal. 4. p. 95. t. 45. Caju cantekka Javanis. Habitat in utrisque Indiis." In this synonymy he includes names now not only reduced to A. germinans, but also some now regarded as applying to A. alba Blume and A. officinalis L.

The Conocarpus procumbens L., referred to in the synonymy of A. germinans (above) is a synonym of what is now known as C. erecta L. in the Terminaliaceae.

Humboldt, Bonpland, and Kunth (1817) adopt "Avicennia tomentosa. Linn. Jacq." as the name for this taxon, citing as synonyms "A. foliis subtus tomentosis. R. Brown. prod. 1. p. 518. Avicennia tomentosa. Linn. Jacq. Am. p. 178. t. 112. f. 2. Sp. pl. ed. W. 3. p. 395. Lam. Encycl. 1. p. 330. Avicennia resinifera. Forst. prodr. n. 246, (ex Brown.) Avicennia africana. Beauv. Flor. d'O-war. 80. t. 47. (ex Brown.)" and describing it as "Crescit ad litora maris Antillarum et Oceani Pacifici. h. Planta certe valde polymorpha: Avicennias vero foliis subtus tomentosis semper pro varietatibus unius ejusdemque Avicenniae tomentosae habendas esse, vix crediderim, minime tamen contrarium confirmare volo, quia eas in loco ipso natali observare nondum mihi licuit."

They then describe three New World varieties as follows (the abbreviated diagnoses only given here): "1. Varietas cumanensis; foliis oblongis aut elliptico-oblongis, utrinque rotundatis, brevissime petiolatis, supra nigro-viridibus. Mangle Prieto incolarum. Crescit ad litora maris Cumanensis.....2 Varietas campechensis; foliis oblongis, obtusis, basi cuneatis, supra nigro-viridibus. Crescit prope Campeche Mexicanorum.....3 Varietas guayaquilensis; foliis oblong-lanceolatis, acutiusculis, basi cuneatis, supra laete viridibus. Crescit prope Guayaquil Quiten-sium." In his amplified descriptions he asserts that the leaves of var. cumanensis are 2.6—4.8 cm. long and 1.6—1.8 cm. wide, those of var. campechensis are 7.8—8.4 cm. long and 2.8—3.2 cm. wide, and those of var. guayaquilensis are 9.6—11.2 cm. long and 2.4—3 cm. wide.

It appears to me now that his var. campechensis represents the typical A. germinans, while his var. cumanensis and var. guayaquilensis are distinct, albeit very closely related laxa. His leaf-dimensions are, on the whole, quite accurate.

Curiously, Sessé & Mociffo (1894) appear to separate the entirely smooth-leaved taxon, which they ascribe to Cuba and Bahia (Brazil) and designate as A. nitida Jacq., from the taxon with the underside of the leaves "albicantibus", which they ascribe to "Habitat ad Alvaradi fluminis ripas" and which they designate as A. nitida Sessé & Mociffo!

Hansford (1961) records the fungus, Asteridiella sepulta (Pat.) Hansf. [Meliola sepulta Pat., Irene sepulta (Pat.) Toro, Irenina sepulta (Pat.) Stev.] growing on Avicennia germinans in Puerto Rico, based on Heller 390 & 6416 and Whetzel 612. Kohlmeier (1966) adds to fungi, Didymosphaeria enalia Kohlm. and Mycosphaerella pneumatophorae Kohlm., based on Kohlmeier 2735 from the Bahamas; in his 1967 work he adds Buellia haliotrepha, Hydronectria tethys, Leptosphaeria avicenniae Kohlm. [based on Kohlmeier 2735 from the Bahamas], Metasphaeria australiensis, and Torpedospora radiata Meyers; in 1968 he added Lulworthia sp., Paraliomyces lentiferus Kohlm., Phoma sp., Macrophoma sp., and Culcitalna achraspora Meyers & Moore. The Kohlmeiers (1971) further added to this list of fungal parasites Lignicola laevis Höhnk. (but from South Africa, so obviously on A. marina (Forsk.) Vierh. rather than on A. germinans!) and Rhaphidospora avicenniae J. & E. Kohlm., as well as the borer, Nausitoria excolpa, from the dead wood of roots and branches. Dennis (1970) also records Asteridiella sepulta on this host in Trinidad.

Material of A. germinans has been widely misidentified and distributed in herbaria as A. marina (Forsk.) Vierh., A. officinalis L., or Laguncularia racemosa. Benoist (1931, 1933) lists an "Avicennia officinalis" from French Guiana which must be either A. germinans or, more likely, its var. guayaquilensis.

On the other hand, the J. T. Baldwin 13050, F. R. Fosberg 40637, and Vigne 353, distributed as A. germinans, are actually A. africana P. Beauv., while H. M. Curran 16 and G. Gardner 1101 are A. elliptica Holm; Drouet 2442, Ducke 5407, Lanjouw & Lindeman 301, and Martius 2644 & s.n. are A. elliptica var. martii Moldenke; Bonpland 68, Curran & Haman 550, Dugand & Jaramillo 4178, Elias 455 & 1156, Gines 3347 & 4221, M. L. Grant 10705, J. R. Johnston 138 & 139, Killip & Smith 21076, F. W. Pennell 12005, Saravia T. & Johnson 514, and H. H. Smith 420 are A. germinans var. cumanensis (H.B.K.) Moldenke; Black 48-3237, W. E. Broadway 2562, Crosby 41, Curran & Haman 1343, Ducke 5405, Eggers 5897, R. Espinosa E. 2444 & 2450, A. S. Foster 10, Fréès 1818, Florschütz & Florschütz 1927, S. G. Harrison 1673, A. S. Hitchcock 21104, Játiva & Epling 1176 & 2120, H. Kennedy 2281, Lanjouw & Lindeman 1517, 1518, 1520, & 1521, Leechman 7, E. L. Little 6750, Lützelburg 324a, Robertson & Austin 310, Romero-Castafeda 5309 & 9013, Stahel s.n. [September 2, 1934], Trin. Bot. Gard. Herb. 12650 & 12655, and Vargas A. 39 & 45 are A. germinans var. guayaquilensis (H.B.K.) Moldenke; and N. L. Britton 2595, Hahn 759, Nadeaud s.n. [XI.1862], Othmer 157 & s.n. [17/XI/08], and G. Pabst 542 are A. schaueriana Stapf & Leechman.

Additional citations: FLORIDA: Collier Co.: Lakela 29824 (N);

Meebold 26971 (Mu). Dade Co.: Gillis 6809 (Ft--2683); Nelson 1092 (Tu--83142). Lee Co.: Moldenke & Moldenke 29717 (Ac, Gz, Ld); Wilbur & Webster 2525 (Mi, W--2132015). Levy Co.: Godfrey & Redfearn 52828 (Ca--M239856). Big Pine Key: Brizicky & Stern 175 (N, W--226559), 181 (N, W--2265663), s.n. [21 June 1956] (Ba); Killip 32021 (W--1697411), 32899 (W--1785722), 40946 [fruit coll. 1052] (W--2151599); Killip & Swallen 40245 (W--2053649). Biscayne Key: J. A. Churchill s.n. [9 May 1969] (Ln--224772). Bush Key: F. R. Fosberg 42998 (W--2638803). Cedar Key: Kral & Godfrey 2976 (Se--223029). Content Key: Long, Broome, Almeda, & Whitney 2678 (W--2589630). Grassy Key: Stern 1478 (W--2386633). Jug Island: Godfrey 60403 (Ca--M186955). Largo Key: Janish & Janish 447 (Se--187165); Meebold 27884 (Mu); Stimson & Stimson 634 (Ca--M280259). Sanibel Island: Brumbach 7904 (W--2749794). LOUISIANA: St. Bernard Par.: R. J. Lemaire 854 (W--2349655). TEXAS: Cameron Co.: Clover 715 (Tu--98478); R. Ruryon 4031 (Ba), 5897 (Ca--1326714); Tharp, Gimbrede, & Johnson 52-525 (Au); Traverse 1812 (Au--197208); Webster & Wilbur 3035 (Au, N, W--2067840). Jefferson Co.: H. Hildebrand 3 (Au--120833); Mrs. B. Reed s.n. [7 January 1948] (Au--120831). Nueces Co.: Tharp s.n. [Port Aransas, 7-2-?] (W--1873594). Lighthouse Island: Hildebrand & Johnston 541270 (Au). Padre Island: Correll, Lundell, & Johnston 25539 (Ca--1371968). MEXICO: Baja California: A. Carter 2721 (W--2023127); Harbison s.n. [November 27, 1956] (Sd--46358); E. B. Higgins s.n. [November 8, 1952] (Sd--45164); D. F. Howe s.n. [27 Sept. 1964] (Sd--60912); R. V. Moran 7151 (Au--190410, Sd--50497, Tu--177872), 12625 (Ba, Sd--65143), 16666 (Sd--72924); Rempel 173 (Tu--84670); Shreve 7099 (Tu--98477); Taylor & Taylor 15692 (N); J. H. Thomas 7940 (Ca--M195116, Mi, Sd--50418, W--2301492); I. L. Wiggins 5455 (Se--82623, W--1824112), 11487 (Se--136017, W--1976758), 14563 (Au--190353, Se--209032), 16174 (W--2520733), 16666 (Tu--186380); Wiggins & Wiggins 18017 (W--2520600), 18239 (Au--233539). Campeche: Pennington & Sarukhán K. 9623 (N). Chiapas: Matuda 16279 (W--1920540). Jalisco: J. Rzedowski 14605 (Au--233799); Villarreal de Puga 17 (Ip). Nayarit: Stevens & Fairhurst 2028 (Ac). Oaxaca: F. H. Elmore D.21a (W--1945344), D.22 (Tu--84588); Morton & Makrinus 2624 (Tu--98476). Sinaloa: Edw. Palmer 228 (Tu--35143). Sonora: Dennis & Van Asdall s.n. (Tu--173606); Hastings & Turner 64-35 (Sd--61331, Tu--154700); Holguín s.n. [25/V/1966] (Ip, Mi); Lichty s.n. [March 1935] (Sd--10434); Lowe & Turner 3319 (Tu--155863); Mallery & Turnage s.n. (Tu--98474); Phillips 3483 (Tu--82868); Shreve 6120 (Tu--98475); Studhalter 1386 (W--1685696). Tamaulipas: Strother 545 (Au). Veracruz: Chávez Ortiz s.n. [27/X/1964] (Ip, Mi); A. Mendoza s.n. [14/VI/1964] (Ip); Pennington & Sarukhán K. 9131 (N); Ventura A. 5226 (Mi, Tu--183748). Yucatán: W.

D. Stevens 1130 (Ln--245052). GULF OF CALIFORNIA ISLANDS: Alacran: F. R. Fosberg 41866 (N, W--2430991), 41904 (W--2430969). Carmen: Carter & Ferris 3733 (W--2539493); R. V. Moran 3926 (Ba, Sd--50290), 9168 (Sd--66201); Pennington & Sarukhán K. 9405 (N). San Francisco: R. V. Moran 9549 (Mi, Sd--66175). San José: J. R. Hastings 71-167 (Sd--78800, Tu--179476); R. V. Moran 9421 (Sd--66202). MAGDALENA BAY ISLANDS: Punta Edie: Beauchamp 2131 (Sd--79286, Tu--180613). MEXICAN OCEANIC ISLANDS: Maria Magdalena: C. Davidson 2045c (Sd--90883); F. H. Elmore IB.2 (W--1945323). BELIZE: Dwyer, Elias, & Maxwell 5 (E--1839550); Fosberg & Spellman 54272 (W--2696561); C. L. Lundell 7009 (Tu--121734, Vt, W--2134422); Spellman & Stoddart 2225 (W--2751317); D. Ugent 41 (Ws).

BRITISH HONDURAN ISLANDS: Buttonwood: Fosberg & Spellman 54421 (W--2724060). Coco Plum: Spellman & Stoddart 2567 (W--2751318). Hatchet: Fosberg & Spellman 54395 (W--2696573). Little Water: Fosberg & Spellman 54343 (N, W--2696574). Manowar: Fosberg & Spellman 54204 (N, W--2724059). Northeast: Fosberg & Stoddart 53854 (W--2676233). North Silk: Fosberg & Spellman 54272 (N). Rendevoux: Spellman & Stoddart 2498 (W--2751323). Seal: Spellman & Stoddart 2481 (W--2751322). Soldier: Stoddart 461 (N, W--2638350). South Water: Spellman & Stoddart 2157 (W--2751360). Tobacco: Fosberg & Spellman 54243 (N, W--2724061), 54456 (W--2696575). HONDURAS: Valle: Molina R. 8635 (N), 21454 (N). BAY ISLANDS: Ráton: Molina R. 23287 (N); Molina R. & Molina 22779 (N). EL SALVADOR: La Paz: P. H. Allen 7278 (W--2297023). La Union: Beetle 26263 (W--1809261). Sonsonate: P. H. Allen 6837 (W--2366480). NICARAGUA: Managua: Atwood & Neill AN.32 (Id).

COSTA RICA: Guanacaste: F. H. Elmore E.1 (W--1945372); D. E. Stone 1974 (Mi). Puntarenas: P. H. Allen 5631 (W--2022269); Lems 5026 (N, W--2582497). PANAMA: Bocas del Toro: Wedel 987, in part (E--1227331, W--1923436). Canal Zone: P. H. Allen 1724 (E--1189377); Stern, Chambers, Dwyer, & Ebinger 50 (E--1757650, W--2396248); Tyson 1261 (E--1817318). PEARL ISLANDS: San José: I. M. Johnston 1129 (E--1591148, W--2024259), 1295 (W--2024297). BERMUDA ISLANDS: Main: Flynn 39 (Vt), "P" (Vt). BAHAMA ISLANDS: Andros: E. Y. Dawson 26836 (W--2458821, W--2458831). Cat: Byrne 179 (Ws). Easter: Howard & Howard 10205 (Se--185963, W--1956212). Hummingbird: Nickerson 2798 (Ft--8455, Ft--8457); Nickerson & Gross 3027 (Ft--8458). New Providence: Gillis 8376 (Ft--7754). Well's: D. S. Correll 45558 (N). CUBA: Havana: Ekman 456 (W--2113558); C. F. Morton 10296 (W--2350871). Las Villas: R. A. Howard 4940 (W--1843884). Matanzas: C. F. Morton 10235 (W--2350817). Province undetermined: Sagra 457a (P). ISLA DE PINOS: Killip 43914 (W--2176017). CAYMAN ISLANDS: Grand Cayman: N. Chevalier 142 (N). JAMAICA: P. Browne s.n. [Herb. Linn. 813.2; neg. 4964] (Ba--photo

of type, Ls-type); Harris & Lawrence C.159 (W--2096933), C.15546 (W--2096970); Papenfuss s.n. [June 21, 1932] (Ca--M186404); Shreve s.n. (Tu--98479); Stearn 287 (Ba), 325 (Ba); West & Arnold 295 (W--2388341); West, Arnold, & James 424 (W--2388342). HISPAN-IOLA: Dominican Republic: Ekman H.14750 (W--1479886); Howard & Howard 8226 (W--2110730); Jacquemont s.n. [1827] (N); J. de J. Jiménez 1344 (W--1883525), 2561 (W--2111240). Haiti: Eyerdam 188 (Se), 20903 (Se--32034); Holdridge 1064 (W--1784035). PUERTO RICO: DeWolf 1908 (Mi, N, S); E. L. Little 13631 (N, W--2633138); F. H. Sargent 44 (W--1558099); Stimson 3036 (Ca--1321757, Mi, N, W--2589733, W--2589734); R. J. Wagner 837 (Ws). VIRGIN ISLANDS: Jost van Dyke: E. L. Little 21998 (W--2705377). St. Croix: D'Arcy 4715 (W--2590853a); F. R. Fosberg 53970 (N, W--2670012); E. L. Little 21555 (N, W--2673575). Virgin Gorda: E. L. Little 23777 (N, W--2690425, W--2690426), 26096 (N, W--2690351). LEEWARD ISLANDS: Antigua: Box 1356 (W--1714298); F. R. Fosberg 48266 (N), 48268 (W--2435535); Gillis 8233 (W--2593647a). Guadeloupe: Questel 2516 (W--1881992), 2517 (W--1881993), 2518 (W--1881994); Stehlé 212 (W--1557945), 1587 (W--1712472). Montserrat: G. R. Proctor 19136 (W--2613809), 19137 (W--2613808). WINDWARD ISLANDS: St. Lucia: G. R. Proctor 17932 (W--2585082). WEST INDIES: Iles Geraires: Prax s.n. [V.1854] (N). COLOMBIAN CARIBBEAN ISLANDS: Providencia: G. R. Proctor 3423 (W--1979264). COLOMBIA: Antioquia: Feddema 2038 (W--2440183). Magdalena: Romero-Castañeda 974 (W--2104624); H. H. Smith 1937 (W--533775). VENEZUELA: Sucre: Campos & Lampe 534 (W--2675347). ECUADOR: Manabi: Asplund 16588 (N, W--2652442).

AVICENNIA GERMINANS var. CUMANENSIS (H.B.K.) Moldenke, Phytologia 30: 15. 1975.

Synonymy: Avicennia tomentosa var. cumanensis H.B.K., Nov. Gen. & Sp. Pl., ed. folio, 2: 229. 1817.

Bibliography: H.B.K., Nov. Gen. & Sp. Pl., ed. folio, 2: 229 (1817) and ed. quarto, 2: 283--284. 1818; Moldenke, Phytologia 30: 15 (1975), 31: 381 & 382 (1975), and 32: 438. 1975.

Humboldt, Bonpland, and Kunth (1817) recognized this taxon as separate from what they called "Avicennia tomentosa", describing it as "var. cumanensis; foliis oblongis aut elliptico-oblongis, utrinque rotundatis brevissime petiolatis, supra nigro-viridibus. Mangle Prieto incolarum. Crescit ad litora maris Cumanensis." The leaves they describe as "18--24 lineas longa, 8--9 lineas lata" [3.6--4.8 cm. long, 1.6--1.8 cm. wide]. Their detailed description is perhaps also worthy of being repeated here, although the phrases above quoted are the important and critical ones. "Ramuli oppositi, teretiusculi, laeves, tenuissime canescenti-tomentosi. Folia opposita, brevissime petiolata, oblonga aut elliptico-oblonga, utrinque rotundata, integerrima, reticulato-

venosa, nervo venisque subtus prominulis, coriacea, supra nigro-viridia, squamulis minutissimis orbiculatis lepidota, subtus densissime et tenuissime cano-tomentosa, 18--24 lineas longa, 8--9 lineas lata. Petioli lineam longi, canaliculati, cano-tomentosi. Spicae axillares solitariae et terminales ternae, pedunculatae, erectae, adjecto pedunculo bipollicares et longiores; pedunculo pollicari rhachidique tenuissime canescenti-tomentosis. Flores verticillati, sessiles, tribracteati; verticilli quatuor in qualibet spica, distantes, tri- quadri- aut quinqueflori, rarius biflori. Bracteae ovatae, acutae, coriaceae, tenuiter canescenti-tomentosae, subaequales, calyce breviores. Calyx campanulatus, quinquepartitus, canescenti-tomentosus; laciniis ovatis, obtusis, subaequalibus, coriaceis. Corolla tubo brevi, infundibuliformi-campanulato, calyce paulo brevior; limbo quadripartito, patente, externe cano-tomentoso; laciniis oblongis, rotundato-obtusis, altera paulo latiore, apice retusa. Stamina quatuor, basi tubi inserta, paulo exserta; duo paulo breviora. Filamenta subulata, glabra. Antherae subrotundae, biloculares, sundidymae, longitudinaliter dehiscentes. Ovarium ovatum, compressiusculum, sericeum. Stylus brevis. Stigma bifidum; laciniis subulatis. Fructus obovatus, obtusus, basi cuneatus, compressus, coriaceus, cano-tomentosus, in specimine nostro nondum maturus."

Recent collectors describe the plant as a shrub, 2 m. tall, or a tree, 4--13 m. tall or more but generally not more than 10 m., halophytic, forming colonies, the leaves green above and whitish beneath. The corollas are described as having been white on Dugand & Jaramillo 4178, Elias 1156, and Gines 3347 & 4221, "cream-white" on M. L. Grant 10705, "white to yellow" or "yellow" on Killip & Smith 21076, and "light-yellow" on Pennell 12005.

Collectors have found it growing on sandy ocean beaches, in the "arid coastal belt", and along lagoons in salt marshes, at altitudes of sealevel to 5 m., flowering in January, March, and from August to October. Smith reports it "common along the seashore" in Magdalena, Colombia, and his specimens have the general aspect of A. schaueria Stapf & Leechman, but have hairy petals. Saravia T. comments that the leaves have the "haz de amarilla, envés verde grisáceo; pétalos blanco amarillentos".

It is well worth noting that the leaves on M. L. Grant 10705, Saravia T. 2434, and Saravia T. & Johnson 514 exhibit only short-petiolate leaves, while those on Gines 3347 & 4221, J. R. Johnston 139 and Saravia T. 2269 & 2288 have sessile leaves. Elias 1156 has its smaller leaves subsessile and its larger ones short-petiolate.

Vernacular names reported for this variety include "mangle", "mangle blanco", "mangle prieto", "mangle salada", and "mangle salado".

Twining (1855) tells us that stands of this plant were most probably the first tropical vegetation that greeted Humboldt and Bonpland when they landed on the Venezuelan coast at Cumana.

The Kennedy 2281 and Vargas A. 39, determined as this variety

in some herbaria, seem, rather, to represent var. guayaquilensis (H.B.K.) Moldenke.

Citations: NORTHERN SOUTH AMERICAN ISLANDS: Margarita: Gines 3347 (W—2174541); J. R. Johnston 139 (Mu, N, W—531968, W—962599). COLOMBIA: Atlántico: Dugand & Jaramillo Mejia 4178 (W—1900171); Elias 455 (S, W—1344952), 1156 (F—709840, N, W—1594975); Killip & Smith 21076 (N, W—1356017). Bolívar: M. L. Grant 10705 (W—2059689); F. W. Pennell 12005 (N). Guajira: Saravia T. 2269 (W—2587765), 2288 (W—2587772), 2434 (W—2587766); Saravia T. & Johnson 514 (W—2587764). Magdalena: H. H. Smith 420 (B, Bm, Br, Cb, Cb, Cl, Cm, E—118596, Ed, Ed, F—137478, H1, Ip, K, Le, M1, N, P, S, Ut, Vt, W—532954). VENEZUELA: Delta Amacuro: Curran & Haman 550 (W—1010898). Falcón: Gines 4221 (W—2167639). Miranda: Oberwinkler & Oberwinkler 14584 (Mu). Sucre: Bonpland 68 (B—type, N—photo of type, Z—photo of type). Zulia: H. M. Curran 140 (N).

AVICENNIA GERMINANS var. GUAYAQUILENSIS (H.B.K.) Moldenke, Phytologia 29: 75. 1974.

Synonymy: Avicennia tomentosa var. guayaquilensis H.B.K., Nov. Gen. & Sp. Pl., ed. folio, 2: 230. 1817.

Bibliography: H.B.K., Nov. Gen. & Sp. Pl., ed. folio, 2: 230 (1817) and ed. quarto, 2: 284. 1818; Moldenke, Phytologia 29: 75 (1974), 31: 379, 381—384, 387, 391, & 392 (1975), and 32: 438 & 454. 1975.

Humboldt, Bonpland, and Kunth (1817) describe this taxon as "Varietas guayaquilensis; foliis oblongo-lanceolatis, acutiusculis, basi cuneatis, supra laete viridibus. Crescit prope Guayaquilensi Quitensium", giving the leaf-dimensions as 9.6—11.2 cm. long and 2.4—3 cm. wide. They add the following details: "Rami ramulique oppositi, teretes, laeves, cinerascetes; internodiis brevibus. Folia opposita, petiolata, oblongo-lanceolata, acutiuscula; basi cuneata, integerrima; reticulato-venosa, nervo venisque subtus prominentibus, coriacea, supra sub lente punctulata laete viridia, subtus densissime et tenuissime incano-tomentosa, 48—56 lineas longa, 12—15 lineas lata. Petioli 6—7 lineas longi, subsemiteretes, interne canaliculati, incani. Inflorescentia verisimiliter ut in praecedentibus [var. campechensis]. Fructus suboblique ovato-subrotundus, compressus, apice subumbilicatus, cano-tomentosus, bivalvis?, monospermus. Pericarpium coriaceum. Epispermium pericarpio adnatum?. Embryo ovatus, compressus. Cotyledones subreniformes, conduplicatae, coriaceae?; interiore minore. Radicula infera, hirsuta. Plumulam haud vidi. Ad figuram Jacquinii valde accedit."

Recent collectors describe this plant as a small or large, erect, bushy tree, 5—22 m. tall, the trunk to 2 feet in diameter, or a shrub, 3—5 m. tall, the trunk diameter at breast height 10—43 cm., the bark black to dark-brown, dark grayish-brown, or grayish, smoothish, with a few cracks, or shallowly fissured, the in-

ner bark yellow or pale-yellow in transverse section, the heartwood dark-brown, the sapwood pale-yellow, producing many small "knees" or pneumatophores the size of a pencil projecting 5--10 cm. above the water, the leaves coriaceous, broadly elliptic, smooth, glossy and medium-green or dark-green above with pale-green veins, dull and pale-green beneath, the flowers small, the calyx green or light-green, the stamens white or brown, the anthers green, white, or blue, the style and stigma light-green, the ovary pale-green, and the fruit green or dull pale-green or even red-tinged. They have found it growing in swamps and mangrove swamps, brackish swamps, on seashores, beaches, and shell-and-mud sea beaches, in saline soil at the edge of rivers, in mangrove thickets, at the borders of tidal flats, along creeks of partially salt water, on small ridges, and on muddy ground back of beaches, at altitudes of sealevel to 10 meters, flowering every month of the year, fruiting in May, June, and September. I should say, in passing that the statement made by some collectors that the tree produces "knees" seems most improbable. I have never seen any evidence of the production of "knees" (such as seen so characteristically in *Taxodium*) in this genus.

Broadway refers to this plant as "the chief mangrove in the vicinity of Cayenne"; Harrison found it "dominant in the mangrove community" of Guyana; Little & Dixon describe it as "common" in Esmeraldas, Ecuador, while Little reports it "scattered at edge of water, common in scattered patches" in the same province; Játiva & Epling assert that it is "the dominant tree in mangrove swamp forests" there. Crosby found it a "common tree" on Trinidad, while Forero & Gentry refer to it as "dominant" in Chocó, Colombia.

Vargas Alvarez describes it as an "Árbol de diámetro de 16 pulgadas con una altura de 63 pies", while Ruiz-Terán & López-Palacios refer to it as an "Árbol erecto, inerme". The corollas are usually described as "white" (e.g., Asplund 18188, Belém & Pinheiro 3039, Black 48-3236 & 48-3427, Crosby 41, Dryander 2613, R. Espinosa E.2959, Forero & Gentry 794, Lanjouw 646, Lanjouw & Lindeman 1352, Little 6750, and Ruiz-Terán & López-Palacios 9747), but were "dirty-white, tube yellow" on Breteler 4673, "white, with yellowish throat and base of stamens" on S. G. Harrison 1534, "cream" on Breteler 5174, "cream-colored with yellow tube" on Breteler 4677, "cream with yellow throat" on Robertson & Austin 310, "creamy-white with yellow center" on S. G. Harrison 1716, "yellow" on Black 48-3237, de la Cruz 1090 & 3463, and N. T. Silva 163, "cream-colored, orange inside the tube" on Breteler 5174 (some sheets), "greenish" on Erlanson 120, and with "tube and lobes green, throat orange" on H. Kennedy 2281 or "corolla-lobes cream-colored with orange-brown tip, tube inside more or less orange" on Breteler 5178.

The leaves are completely glabrous on Breteler 4673, 4677, 5174, and 5178 and these collections may prove to be A. elliptica Holm.

Fróes reports that in Maranhão the wood is used in marine construction, while Vargas Alvarez says "madera usado en dormientes y para entablados". The Stahel s.n. collection, cited below, is a voucher for wood samples sent to Dr. A. J. Pabshin; Vargas Alvarez A.39 is also a wood sample voucher. A pollen sample was taken from Irwin 270 by E. K. Schofield in 1967.

Vernacular names recorded for this variety include "apalioe", "ciriba branca", "comedero", "corinda", "courinda", "iguanero", "jelf salado", "koroda", "mangle", "mangle iguanero", "mangle salado", "parwa", "sietecapas", "siete capas", and "siriuba".

Material of this taxon has been widely distributed in many herbaria as typical A. germinans (L.) L. or as A. nitida Jacq., A. germinans var. cumanensis (H.B.K.) Moldenke, A. officinalis L., A. tonduzii Moldenke, or even Trepanocarpus inundatum Mart. [Schomburgk 845]. On the other hand, the Drouet 2442, distributed as A. germinans var. guayaquilensis, is actually A. elliptica var. martii Moldenke, while Feddema 2038 and H. H. Smith 1937 are typical A. germinans (L.) L.

Citations: COSTA RICA: Puntarenas: Kupper 1552 (Mu). PEARL ISLANDS: San José: Erlanson 120 (N); H. Kennedy 2281 (W—2745254). TRINIDAD AND TOBAGO: Tobago: Eggers 5897 (C). Trinidad: Boccus s.n. [Trin. Bot. Gard. Herb. 12609] (N, R); N. L. Britton 2595 (N, R, W—1194444); W. E. Broadway 2562 (Mu), s.n. [Trin. Bot. Gard. Herb. 3505] (B, R); R. L. Brooks s.n. [Trin. Bot. Gard. Herb. 12655] (N); Crosby 41 (N); H. M. Curran 3 (F—452575, N, W—920310); Curran & Haman 1343 (N); Fendler 1016 (Bm, Ed, Ed, Ed, K, Pa, Ph); R. C. Marshall s.n. [Trin. Bot. Gard. Herb. 12650] (N); Trin. Bot. Gard. Herb. 2394 (R, W—1323373); Warming 202 (Cp, W—1324757). COLOMBIA: Antioquia: Haught 4855 (N, W—1709621). Chocó: Forero & Gentry 794 (N). Magdalena: Romero-Castañeda 9018 (N). Nariffo: Dryander 2613, in part (N, W—1838212); R. Espinosa E.2959 (N); Romero-Castañeda 5309 (N). Valle del Cauca: Breteler 5178 (W—2583203a); Dryander 2613, in part (N). Department undetermined: Lehmann B.T.691 (K, Le, N, V). VENEZUELA: Delta Amacuro: Curran & Haman 1275 (N), 1275a (B, F—559672, N, W—1043156); Gines 5131 (W—2167912); Ruiz-Terán & López-Palacios 9743 (Ac), 9747 (Ld). Sucre: Breteler 4673 (W—2583214a), 4677 (W—2583215a), 5174 (W—2583351a, W—2583352a); W. E. Broadway 528 (N, W—1188039). GUYANA: Archer 2625 (Ar—12015, W—1663250); J. S. de la Cruz 1090 (N, W—1069953), 3463 (Ca—300600, E—917780, F—544140, N); S. G. Harrison 1534 (N), 1596 (N), 1673 (N), 1716 (N); A. S. Hitchcock 16565 (N, S, W—1055867); Irwin 270 (W—2172701); Jermain 4869 (C, N), 5468 (Bm, K, N); Leechman 7 (N); Robertson & Austin 310 (N); Rich. Schomburgk 845 (Bm, C, Cb, Cb, Cl, N, P, P, V, X). SURINAM: Florschütz & Florschütz 1927 (N); Lanjouw 646 [photo 153] (N, Ut);

Lanjouw & Lindeman 1352 (N, Ut--17660b), 1517 (N), 1518 (N), 1520 (N), 1521 (N); Moldenke & Moldenke 19586 (Es, F, Fy, Lg, Mg, Mr, N, No, Ot, S, Sm, Ss, Vi); Stahel s.n. [September 2, 1934] (N, N, N, N, N, N). FRENCH GUIANA: W. E. Broadway 691 (N, W--1068859); Hallé 1043 (N, P); Herb. Barbier s.n. [Guyane] (W--1123312). EC-UADOR: Bolívar: E. L. Little 6750 [Herb. U. S. Forest Serv. 98495] (N). El Oro: R. Espinosa E.2414 (N), 2450 (N); A. S. Hitchcock 21104 (N). Esmeraldas: Játiva & Epling 1176 (N, W--2534040), 2120 (N, S, W--3600727); E. L. Little 6363 [Herb. U. S. Forest Serv. 98224] (Ca--1449728, It, N), 6363 [Herb. U. S. Forest Serv. 29224] (W--1859876); Little & Dixon 21220 (N, W--2644953). Guayas: Asplund 15221 (N, S), 18188 (Ca--1449711, N, S, W--2652443); Humboldt & Bonpland s.n. [Guayaquil] (N--photo of type, P--isotype, P--isotype, P--isotype, P--isotype, N--photo of type); E. L. Little 6750 [Herb. U. S. Forest Serv. 98495] (Ca--1449729, W--1954859); Mille 87 (N); Schimpff 379 (B, B, Cb, Cb, E--1088364, W--1619455). Province undetermined: Rimbach 54 [Yale Herb. 20747] (Ca--501845, Du--223846, F--690258). GALAPAGOS ISLANDS: Charles: A. Stewart 3267 (Bi, E--817127, Gg--31352, N, W--921580). Seymour: E. W. Elliott s.n. [1945] (W--1564050). Santa Cruz: Schimpff 30 (B, Bm, Cb, E--1072247, Gg--212443, N, P, S, Ut). PERU: Pancho Island [Tumbes]: Vargas Alvarez 39 [tree 26 T] (N, Ws), 45 [tree 26 T] (N, Ws). BRAZIL: Amazonas: Black 48-3236 (N). Bahia: Belém & Pinheiro 3039 (Ld, N); Lützelburg 324a (Mu). Maranhão: Ducke 5405 (N); Fröes 1818 (N). Pará: Black 48-3237 (Ca--M073003, N); A. S. Foster 10 (N); N. T. da Silva 163 (Be--42567, Ca--M072749, W--2252781). MARAJÓ ISLAND: Black 48-3427 (Be--37915, Ca--72920, Ca--M072920, Ut--74081b). CULTIVATED: Guyana: Mell & Mell 248 (N, W--1481570).

AVICENNIA LANATA Ridl.

Additional bibliography: Fedde & Schust. in Just, Bot. Jahresber. 53 (1): 1068 [1050] (1932) and 54 (2): 746. 1934; Navalkar, Journ. Bombay Nat. Hist. Soc. 53: 341. 1956; Bascope, Bernardi, Jorgensen, Hueck, & Lamprecht, Inst. Forest. Latinoam. Invest. Capac. Descrip. Arb. Forest. 5, ed. 1, 13. 1959; R. Good, Geogr. Flow. Pl. 240. 1964; Burkill, Dict. Econ. Prod. Malay Penins. 1: 275 & 277. 1966; Moldenke, Phytologia 15: 475. 1968; Corner & Watanabe, Illustr. Guide Trop. Pl. 750. 1969; Tan & Keng, Journ. Singapore Nat. Acad. Sci. 1 (3): 8--29. 1969; Bascope, Bernardi, Jorgensen, Hueck, & Lamprecht, Inst. Forest. Latinoam. Invest. Capac. Descrip. Arb. Forest. 5, ed. 2, 13. 1970; V. J. Chapm., Trop. Ecol. 11: 5, fig. 3. 1970; Anon., Biol. Abstr. 52 (14): B.A.S.I.C. S.22. 1971; Korr, Biol. Abstr. 52: 7887. 1971; Moldenke, Fifth Summ. 1: 303 & 393 (1971) and 2: 792 & 839. 1971; Balgooy, Pacif. Pl. Areas 3: 243. 1975; Moldenke, Phytologia 32: 362 & 451 (1975) and 33: 260. 1976.

Additional illustrations: Corner & Watanabe, Illustr. Trop. Pl. 750. 1969

[to be continued]